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THE POSSIBILITIES OF AMERICAN EXPORT TRADE.

The talk of export commerce in the United States is of distinctly recent origin. There are two incidents widely different in character and effect which probably did more than anything else to interest thinking Americans in the possibilities of developing commerce outside the confines of their own country. One of these was the war with Spain, attracting our attention to plans for colonizing and for the government of dependent countries at a distance, and giving many young and active men opportunities for travel. The other was the result of another war—that which General Kitchener was waging against the Mahdists, in the Soudan. It was the building of the Atbara bridge. The history of this astonishing piece of engineering is too familiar to need repetition; suffice it to say that the performance of American engineering concerns as exhibited by this exploit of construction opened the eyes of the world. It was not long afterward that the newspapers were filled with talk of British railways buying locomotives in the United States.

With the recognition that outside our shores lay an immense and, so far as Americans were concerned, an untouched market in which our goods could claim a high place, there came a natural desire on the part of manufacturers to engage in what must be a most profitable commerce. Unfortunately, our makers of goods have not had the long experience in such traffic that has marked the prosperous career of their British rivals, and hence they have much to learn. It is partly with a view to show a little of what has been done, and thus to stimulate effort to do more, that this issue of the ELECTRICAL REVIEW is devoted almost wholly to descriptions of American electrical engineering works abroad and to recording the reception of American electrical goods in foreign markets.

From the very first days of the electrical industry this country, in which the development of a new art is unhampered by tradition, has taken the first place. The illustrious names of its inventors are known the world over. There is no doubt that in this development of engineering American products are *par excellence* the best. This fact alone, however, has not sold them to consumers who have been approached by the active and energetic salesmen of foreign houses—men who have studied to meet the needs and please the tastes of their customers. It is precisely this that the American manufacturer must do to make his new effort productive and satisfactory.

It is pleasing to note that the energy and directness of method that has marked American advance in all directions is evident in the effort to gain new fields of industry. This country has been for many years the granary of the world. Its agricultural preeminence has been incontestable, but the future, when the vast Siberian empire of Russia shall be in cultivation, is not particularly bright for the agriculturist. More and more we are becoming a manufacturing country. We have now begun to be an export country. Can any one doubt that the end of the first quarter of the coming century will see us as preeminent in export and manufactures as we are now in agriculture and mining?

AN IMPORTANT TELEPHONE DEAL.

The sale of the Erie Telegraph and Telephone Company to the Telephone, Telegraph and Cable Company of America, as announced elsewhere, is an important transaction. It transfers from the control of the American Bell Telephone Company about one-sixth of its operating interests. It will be readily appreciated that this deal will attract con-

siderable attention in telephone circles and is reported to have been quite a surprise to the parent Bell Company, in Boston. A noticeable feature is that the subsidiary companies controlled by the Erie Company are entitled, under contract, to every privilege granted to other Bell licensees; yet they now pass into the hands of parties competing with the American Bell Telephone Company and its licensees.

The great increase in demand for telephone service, and the apparent desire on the part of the telegraph companies to enter this field, make this recent sale of abiding interest and additional developments may be expected.

CONCERNING GUTTA-PERCHA.

On another page will be found an article on the sources of gutta-percha, by Mr. Hawthorne Hill, whose position as an authority on this subject makes his opinions of peculiar value. The construction of a Pacific cable will depend largely, if not entirely, upon the possibility of obtaining the requisite gutta-percha. Mr. Hill is inclined to think that the gum will be forthcoming and we are heartily glad to know that its sources are more numerous and wide-spread than had been thought.

MEXICO AND SOUTH AFRICA.

In the article by Dr. Louis Bell, on the next page, some conditions governing the exploitation of long-distance electrical transmission plants in Mexico are set forth with the author's usual clearness of expression. The problem that he attacks in his article is one of extreme interest. There are two places in the world at present where the conditions requisite for successful operation of very long distance transmission lines exist; one of these is Mexico and the other is that portion of South Africa which is now the scene of a most regrettable war. In both these countries there are large mines dependent upon power for their operation; in both of them there are natural sources of power; in both of them fuel is scarce and dear; in both of them the climate is dry and favorable to the use of high voltages for transmission purposes. The case which Dr. Bell has described and for which he gives some figures of cost and maintenance, is one that must be typical of many others existing in these countries. To them the attention of American manufacturers of electric plants should be directed at once.

THE ELECTRIC GUN.

For about two months past the newspapers have been filled with a story about the remarkable invention of a Mr. Gardner, of New Orleans. It appears that he has invented a new kind of cannon, which he calls an electric gun, and which shoots a fearful stream of death-dealing projectiles at an incredible velocity without the aid of powder or other explosive—so long as its operations are confined to the notebook or paper pad upon which Mr. Gardner writes. Last Sunday a prominent New York newspaper published a full-page description of the great gun and a portrait of its inventor, and showed it in the act of destroying battleships at about five hundred yards range. The principle upon which this extraordinary piece of ordnance works is the same that was employed by the Port Electric Railway System, some time since deceased, and consists of a series of solenoid coils surrounding the bore of the gun (which may be of light material and a non-magnetic character) and into which is put a magnetizable projectile. Naturally this is drawn forward into the first coil, where it strikes a spring and energizes the next one ahead of it. This pulls it forward, and so it travels with an increasing velocity until it is projected out of the end of the gun with amazing speed and violence. All this reads like a romance, and as such it was published in the ELECTRICAL REVIEW for August 3, 1898. In this article, which was entitled "An Electric Gun," Mr. Gardner's principle was expounded and in addition a little calculation was made and it was figured out that a gun to project a shot for a distance of 20 miles would consume a modest current of 19,000 amperes at 1,000 volts—in other words, about 25,380 horse-power—for a second, and that it would require to be about 1,500 feet long. If the gun were shortened to 100 feet, which would give the projectile only one-fifteenth of a second to be accelerated to its velocity, a little matter of 280,700 horse-power would have to act upon it for this length of time, or say about 95,000 amperes at 3,000 volts. This much energy, if it were constantly acting, would only cost 35 cents for the one-fifteenth of a second necessary, so that from this point of view the gun would be reasonably economical. Unfortunately, however, the calculations were based upon the assumption that such a thing as self-induction does not exist. The gun and its power plant would cost about $21,649,000 at the usual prices of electrical apparatus.

As an illustration of what the Sunday newspapers, combined with a considerable degree of presumptious ignorance, can do for a man, the fame of Mr. Gardner is almost without parallel.

STOCK SELLING SCHEMES.

The ELECTRICAL REVIEW often receives letters from people all over the United States, asking if certain stocks are good investments, and inquiring as to the reliability of various promoters and schemers who have sent them circulars. Only the other day a letter was received from a clergyman in an interior village, who stated that he had been sent a circular quoting the stock of a new electrical enterprise at a low price, and offering such remarkable inducements that he felt inclined to invest in it provided we advised the purchase.

Among the most serious difficulties that have surrounded the commercial growth of electrical concerns has been the swindling that has associated with itself the name of electricity. Every wild and impracticable scheme, whether it be for the extraction of gold from sea water, or the transportation of passengers at some fearful rate of speed, or the refining of sugar at practically no cost, has been called electrical. There is nothing that has so damaged the legitimate and honest concerns who are endeavoring to put forward electrical methods and apparatus, as the depredations of such piratical offenders as those who have sailed under false colors in electrical channels. It is therefore to the interest of all who are connected with the legitimate enterprises in this field to aid in exposing and stopping the operations of fraudulent concerns. It is hard sometimes to draw the line separating those who are really fraudulent from those who are self-deceiving, but as a general proposition it is safe to say that no reputable enterprise with a chance of earning dividends goes to the extreme of sending circulars to country preachers. It is generally the poor or those of very modest means who are the victims of the swindling promoters of the type of the late infamous Jernigan.

A FIELD FOR LONG-DISTANCE TRANSMISSION.

CIRCUMSTANCES LIMITING TRANSMISSION DISTANCE—THE POSSIBILITIES OF MEXICO—A TYPICAL CASE—CALCULATIONS FOR A LONG LINE—ENGINEERING VALUE OF TRANSMISSION TO GREAT DISTANCES.

BY LOUIS BELL.

One of the questions oftenest asked of the engineer is the limit of power transmission in distance and voltage. Broadly speaking, the problem is indeterminate, for the distance practicable is a function of the price of fuel, and the voltage is in the main a function of the climate.

To make a trial at very long range and extreme voltage feasible, the necessary combination of circumstances consists of a good market, a very high price of coal, and a climate dry enough to make insulation easy. Given these conditions and we may reasonably expect something of a revelation in the way of power transmission.

To the best of the writer's knowledge, the one region to which one may reasonably look for the next great step is the neighboring republic of Mexico. A few years since there came to the writer a most intelligent Mexican gentleman with a proposition for power transmission on a scale that was fairly startling. It involved sending a thousand horse-power over a line 200 miles long to a group of silver mines in the mountains.

At first it looked rather desperate commercially, but on careful investigation it showed every indication of being a paying proposition. At the mines in question, coal cost $40 per ton in gold—for every ounce of it had to be carried 80 miles in bags on the backs of burros. The water-power was one of the magnificent high heads common along the back bone of the continent, and was not itself inaccessible, while over most of the route rain was a sort of septennial institution, not to be seriously considered. All this was seven years ago and the slump in the price of silver put the proposition to sleep shortly afterward; but it will be instructive in the light of our present experience to compute the proposition anew, and to see the possibilities it opens to both commercial and electrical enterprise.

To begin with, we must realize that the present upper limit of high voltage seems to be set by the tendency of the air to fail as a dielectric. So far as the transformers are concerned the splendid insulating properties of oil have not been put seriously to the test by even the highest experimental voltages. Given the necessity and there would be no serious difficulty in the way of building large transformers to deliver to the line pressures of 100,000 volts or more. Glass and porcelain and oil will stand the strain. But the air begins to play one false long before this. With ordinary commercial machines at ordinary frequencies the losses by leakage through the air between line and line are sufficiently formidable at 50,000 volts to call a halt in further progress, and this even with wires four or five feet apart. Ten or fifteen thousand volts more may be gained by using generators giving a close sinusoidal wave and spacing the wires still wider.

For a working voltage one might safely go under existing conditions in a very dry climate to 50,000 volts. Let us see what sort of a line this will give. Take the energy generated at 1,000 kilowatts and assume the distance as 200 miles and the loss at 10 per cent.

Using the stock formula for three-phase lines

$$c.\ m. = \frac{D + 11 + \frac{W}{V}}{V_1}$$

one has $D = 1060$, $\frac{W}{V_1} = 20$, $V_1, = 5{,}000$ and the case calls for 46,640 circular mils. This is not far from No. 3, which would probably be chosen for the purpose. As to the matter of inductance with wires about six feet apart and at a frequency of 40~, the impedance factor of the line is so near unity as to be amply compensated by the extra cross-section of the conductor, leaving the drop at just about the assumed figure. As to resonance the constants of the line do not give a period anywhere near the frequency, so that no trouble need be borrowed on that score.

Now for the copper: About 3,200,000 feet of No. 3 would be required, weighing about 160 pounds per 1,000 feet, in all about 512,000 pounds, worth, delivered, about $100,000.

For the line one would need about 8,000 poles, and for a rough estimate of the cost, set with wire in place, allow another $100,000. Hydraulic costs are very variable, but taking our data from a typical high head plant of this capacity will give a useful approximation. $50,000 is not wide of the mark for this item, and allowing a proper amount for dynamos, transformers and general equipment, including the very necessary telephone line, it is quite safe to say that the total cost of the plant, including a moderate amount of distributing circuit, would fall within $350,000.

On this amount 20 per cent should easily pay all fixed charges and operating expenses, so that a sale of 1,000 horse-power at $100 per horse-power year, would not only care for all the fixed expenses but pay interest on the stock of the concern and provide a liberal sinking fund. Now, in point of fact, the price noted is less than the cost of producing power in units of moderate capacity, even in localities where coal is no more than $5 or $6 per ton. If coal rises from transportation charges to the neighborhood of $10 per ton, electrical power, transmitted even so great a distance, could cut under the cost of steam power very materially and secure a paying market. On a larger scale, the cost of transmitted power would, of course, fall below the estimate given, and by so much the more give it the advantage. There is every reason to expect, then, that a 200-mile transmission from water-power would pay in a good many instances, given only a reasonably good market.

Obviously it would pay handsomely under conditions anything like those noted in beginning this article. There is little doubt that it would have been a good investment seven years ago in spite of the falling silver market, for it would have greatly reduced the cost of production at the mines concerned.

Although it is not difficult to figure out a profit in even longer transmissions on a large scale, we are not likely to get capital interested in such enterprises until some case has been worked through to commercial success under conditions so favorable as to leave no doubt of the result. It is doubtful whether such conditions exist within the limits of our own country, although ultimately we may expect long-distance work on a colossal scale.

In Mexico and portions of South America, however, one may reasonably expect to find such cases as have been instanced, and it is to this quarter that we must look for the pioneering work that has to precede anything like settled practice.

Possibly in a favorable climate it would be worth the while to experiment with voltage even above 50,000, with the help of very widely spaced wires and extraordinary precautions in insulation. Such a procedure of course increases the cost of the pole line, while decreasing the cost of copper alone, and at a certain point further increase would cease to pay. It is doubtful, for instance, whether it would pay to increase the distance between wires to the extent of using separate pole lines for each leg of the circuit, but there is still great room for improvement in line insulation in general.

The engineering value of a very long transmission at extreme voltage would be very great, and the present note is intended to call attention to the fact that under circumstances which actually exist such an enterprise can have a commercial value fully commensurate with its scientific importance.

American Electric Ore-Handling Apparatus in Europe.

It is pretty generally known that the Brown Hoisting and Conveying Machine Company, of Cleveland, Ohio, has made a specialty of apparatus of all sorts for the handling, rehandling and storage of raw materials. This company has brought to bear engineering ability of an exceptional character to problems requiring apparatus almost human in its manipulation and operation. The ELECTRICAL REVIEW has already published illustrations of numerous cranes of tremendous capacity and reach built by this firm for ship yards in the United States and abroad. The illustrations on this page show two very interesting examples of ore-handling apparatus built by the Brown Company and installed on the continent of Europe.

In Fig. 1 is shown a view of two standard bridges used for storing and rehandling iron ore at the furnace of the Societe de la Providence, at Marioupol, South Russia, on the Sea of Azof. The operation of the bridge is apparent from a glance at the illustration. Each bridge is operated by an Elwell-Parker electric motor which has a capacity of from 80 to 120 horse-power.

Another very interesting plant installed by the Brown Company is shown in Fig. 2, which is a view of four standard bridge tramways installed for the Kranische Industrie Gesellschaft, at Trieste, Austria. Each of these bridges is 180 feet span, 90 feet cantilever expansion and a 34 feet front hinged apron extending over vessels docked below the bridges. This apparatus is used for unloading and storing iron ore and each bridge is operated by an Elwell-Parker constant potential motor of from 80 to 120 horse-power.

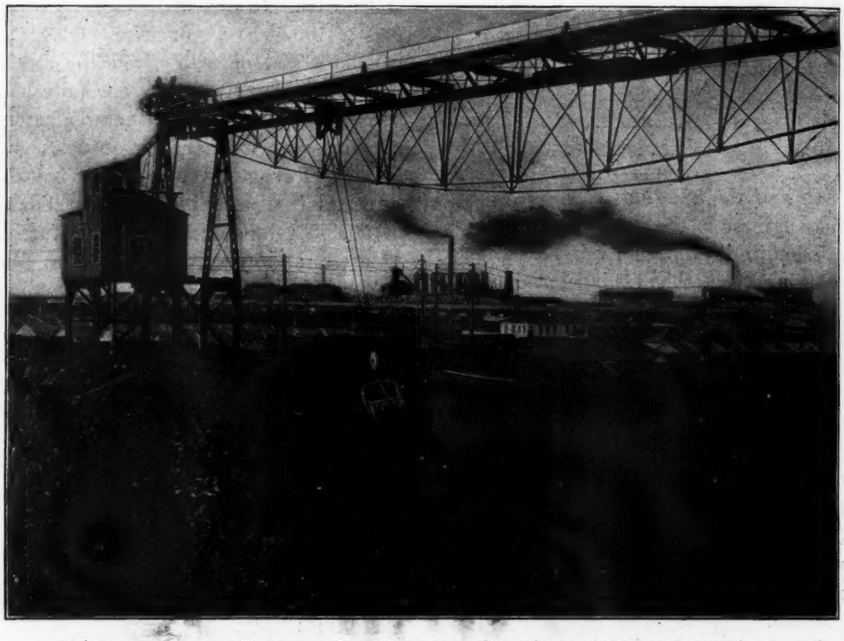


FIG. 1.—AMERICAN ELECTRIC ORE HANDLING MACHINES AT MARIOUPOL, RUSSIA.

The plants illustrated herewith are but two of the many installed in continental Europe by the Brown Hoisting and Conveying Machine Company, which has for some years made a specialty of export work of this character, and has met with much success in solving the difficult engineering problems involved in it.

FIG. 2.—AMERICAN ELECTRIC ORE HANDLING MACHINES UNLOADING SHIPS AT TRIESTE, AUSTRIA.

Electric Lighting Consolidations.

Certificates of merger of the Manhattan Electric Light Company, capital $1,500,000, and the Harlem Lighting Company, capital, $250,000, with the Edison Electric Illuminating Company, of New York, have been filed at Albany, N.Y. The Edison Company was itself some time ago practically absorbed by the New York Gas and Electric Light, Heat and Power Company, which latter corporation is now under the control of the Consolidated Gas Company interests.

American Institute of Electrical Engineers.

The 140th meeting of the Institute was held at No. 12 West Thirty-first street, New York, on Wednesday, February 28.

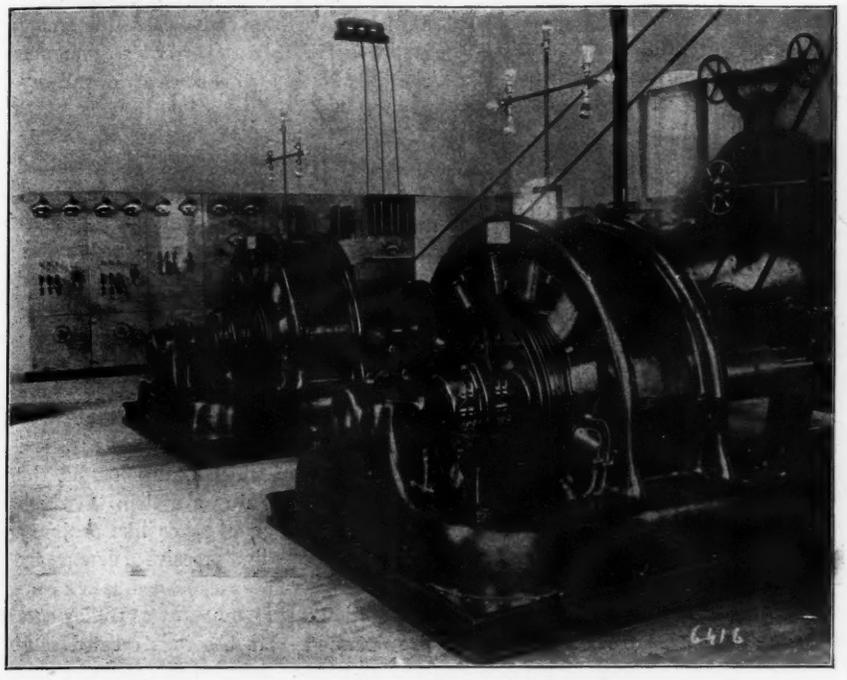


FIG. 2.—THE GENERATING PLANT AT BAMBA, SHOWING TURBINES, GENERATORS, SWITCHBOARD AND CONNECTION TO THE TRANSMISSION LINE.

A note on "A Faradmeter" was presented by Dr. M. I. Pupin, and the instrument described and explained by the author was exhibited by him. Messrs. Hering, Wolcott, Bradley and Reed took part in the discussion.

A paper was presented by Edward C. Boynton, of New Haven, entitled "Notes on Electric Traction Under Steam Railway Conditions." The discussion was opened by Mr. F. J. Sprague and continued by Messrs. Hutchinson, Hanchett, Lamb, Ries, Pope, Holbrow, Mailloux, Atwood and Emerson.

At the meeting of the executive committee in the afternoon the following associate members were elected:

Howell Henry Barnes, Mexico City; John Duncan Boyd, Marysville, Cal.; Clement W. Evans, Mexico City; Lewis Warner Henry, Mexico City; A. M. Hunt, San Francisco, Cal.; William G. Lawrence, Hudson, Mass.; J. L. McCreary, Mexico City; H. D. McVay, Wichita, Kas.; Morris M. Neurath, Chicago, Ill.; Franz Oscar Renstrom, Pachuca, Mexico; Mariano L. Schiaffino, Guadalajara, Mexico; Walter Eugene Smith, Philadelphia, Pa.; George Lourie Wiley, Arlington, N. J.; J. M. Zapata, Mexico City.

Mr. Edward J. Willis, of Richmond, was transferred to membership.

It was voted by the executive committee that the annual business meeting should be held in New York city, on May 15, the date fixed by the constitution at which the ballots for new officers will be canvassed. On the afternoon of the following day, May 16, the general meeting for the reading and discussion of professional papers will open at Philadelphia, continuing possibly for three days.

An American Power Transmission in the Argentine Republic.

At Cordoba, in the Argentine Republic, the Cordoba Light and Power Company (which is a New York corporation) has erected an electrical power transmission plant between that city and the village of Bamba, 18 miles distant, in the Sierra de Cordoba mountains.

The handsome illustrations shown herewith represent the head of the penstock at Bamba, the station at Bamba, and the receiving sub-station in the city of Cordoba.

The character of the country, as may readily be judged from Fig. 1, is mountainous and difficult to the last degree. It was necessary in building the hydraulic installation at Bamba to construct a tunnel through the hard stone of the Cordilleras. In the station, which is a stone and concrete building, are installed three 21-inch McCormick turbines of 500 horsepower each, manufactured by the Rodney-Hunt Machine Company.

These are directly-coupled to three General Electric Company's three-phase, 12-pole, 700-volt generators, arranged for separate excitation. A most elaborate switchboard contains control instruments of all sorts for the generating and transmitting apparatus.

FIG. 1.—END OF THE TUNNEL AND BEGINNING OF THE PENSTOCK AT BAMBA, SHOWING MOUNTAINOUS CHARACTER OF COUNTRY.

The step-up transformers have 700-volt primary windings and 10,850-volt secondary windings. The overhead line is operated at the latter pressure in each phase.

At Cordoba the line ends in a single sub-station, where step-down transformers receive the current at 9,350 volts in the primary and reduce it to 2,080 volts in each phase of a three-phase distribution,

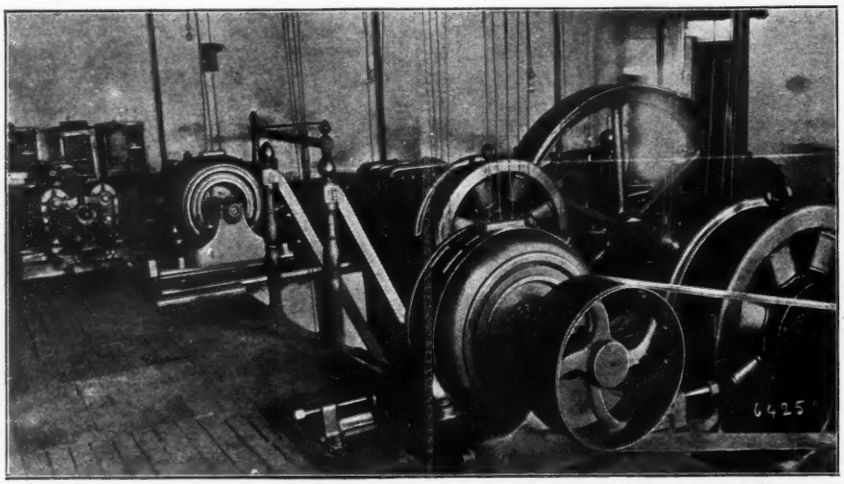


FIG. 3.—THE RECEIVING SUBSTATION AT CORDOBA, SHOWING SYNCHRONOUS MOTORS DRIVING ARC LIGHTING DYNAMOS.

which is extended through the city on overhead lines. This station is well fitted with all the distributing and controlling apparatus for such a system and, in addition, contains three synchronous motors of 120 horse-power each, used for driving arc-light dynamos. The whole plant is one of the finest in South America, and has given great satisfaction since its erection.

Cordoba is one of the principal cities of Argentina, having a population of about 45,000, and is situated in the delightful climate of "the backbone of South America."

OBITUARY.

Mr. Charles Tomlinson Rittenhouse, of New York, died of pneumonia on February 26, in Denver, Colo., where he had gone for his health. His funeral took place at his parents' home, at No. 247 West 138th street, on Saturday, March 3. Mr. Rittenhouse for a few months in 1896 was editor of the *Electrical World,* but was forced to resign on account of his health. He was born in New York in 1871. He was graduated with honors from the electrical department of Columbia University. When Professor Pupin, of Columbia, was experimenting with the X-rays in 1895, Mr. Rittenhouse conducted many of the experiments and took some of the first X-ray pictures in the state. He was a member of the New York Electrical Society, the American Institute of Electrical Engineers and an alumnus of Stevens Institute and Columbia University.

SELF-MOVING ROAD VEHICLES WITH AUTOMOBILE DOUBLE TROLLEYS.

BY E. HOSPITALIER.

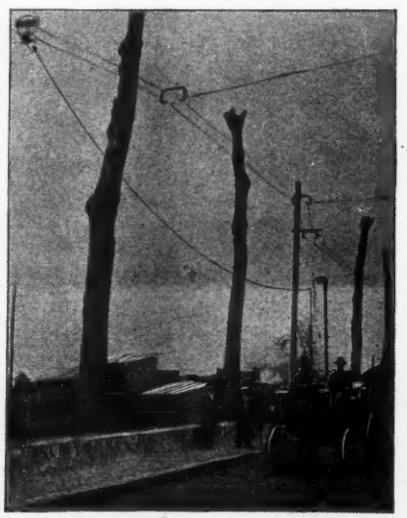
M. E. Hospitalier, in the last number of our French contemporary, *L'Industrie Electrique,* contributed the following interesting account of the experiments in electric road locomotion now being carried on in France, which presents many features of novelty and perhaps of value:

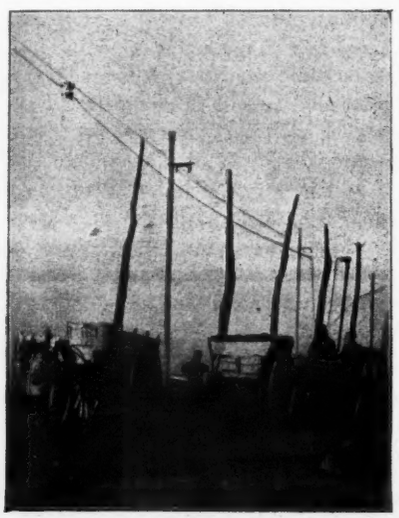
The domain of electrical progress is being rapidly extended in all the departments of terrestrial locomotion, from the powerful locomotives in the tunnels at Baltimore, drawing entire trains of cars including the locomotive, down to the little electric cabs with which the great American cities commence to be dotted, and passing over the electric railways, of which to-day the lines cover the world with a net work of constantly contracting links. Between the trolley car, which is a considerable and costly vehicle, and the electric automobile, which is, and will be for some time, a machine entirely too expensive for public service, it seems necessary to design a mechanical vehicle, omnibus or stage for carrying passengers and goods in those cases where the traffic is not sufficiently important to warrant the installation of an electric railway proper.

The different attempts made up to this time to solve the problem by the aid of steam or gasoline automobiles have not given, so far as I know, very encouraging results; the experiment has not even been tried with electromobiles for fear of a probable failure in an application for which these machines are not destined; at least, not at present.

Can self-moving vehicles succeed where automobiles have failed? This is the question that M. Lombard-Gerin has asked himself, and of which he has sought the solution by designing a system in which the carriages run on roads like ordinary wheel vehicles, but receive current by overhead conductors connected with a central station in the same way as trolley cars are operated. He has thus created self-moving road vehicles—I call them by this name to distinguish them from ordinary automobiles on the one side, since these machines are not self-contained, and from trolley cars on the other, because they do not run on rails.

The idea of working ordinary road-carriages by electric motors fed from a central station through the instrumentality of the double trolley running on two wires strung alongside of the road is not new. Its practical realization, however, has presented much difficulty, now overcome in the new system which has been





FIGS. 1 AND 2.—THE SELF-MOVING ROAD VEHICLE ON THE TRIAL TRACK AT ISSY, FRANCE.

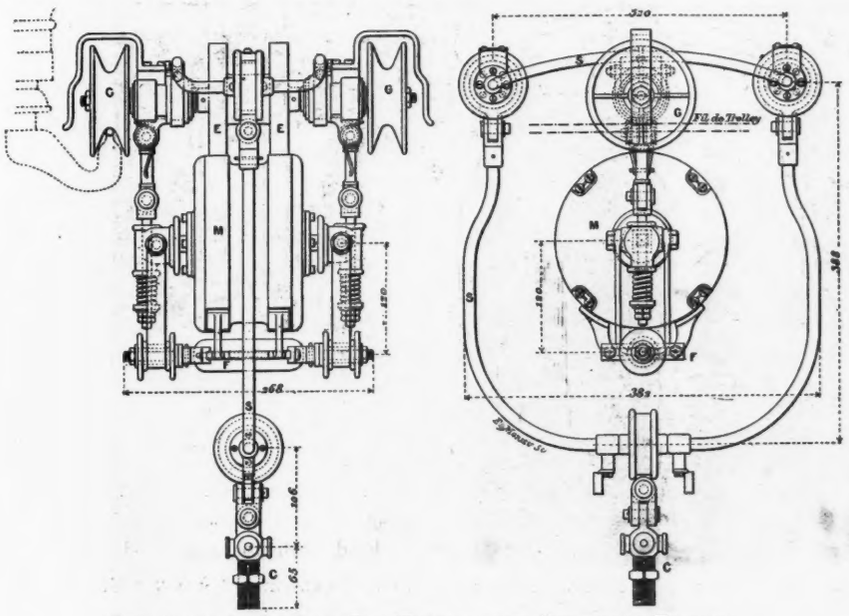
operated over a length of about one kilometre on an experimental line established at Issy, near Paris, on a road running along the left bank of the Seine.

The principal difficulty lies in taking the current, the apparatus necessarily requiring two wires and two trolleys. The wires must be put up on the roadside and the vehicles should be able to get away five or six yards, sometimes more, from them, in order to let other vehicles pass, yet should never lose contact with them for an instant. M. Lombard-Gerin concluded that in place of towing a double trolley along, it would be profitable to make this apparatus an automobile, and by giving it a speed a little greater than that of the vehicle let it run ahead and keep the cable between it and the automobile taut. For this purpose the trolley is operated by a little squirrel-cage type induction motor, working on three-phase current. These currents are produced by the vehicle motor, which carries upon its armature three collector rings connected with its windings.

The double trolley with its motor, to which has been given the picturesque name of *"mouton,"* doubtless on account of its docility, stops itself when the principal motor stops, runs fast when the motor runs fast, and, in a word, follows all the variations in speed of the vehicle. It endeavors continually to run a little ahead, but by sliding back a little, keeps itself at a proper distance.

The arrangements designed and constructed by M. Lombard-Gerin, with the assistance of his chief engineer, M. Bonfiglietti, on the experimental line are shown in the accompanying illustrations. They have been applied to an old electromobile, but it is easily seen that the arrangement can be applied to any form of vehicle.

Figs. 1 and 2 show the system in operation, the vehicle holding its normal place on the road on the right, near the line of poles, whence it can run across to the other side to get out of the way of passing vehicles as shown in Fig. 2.



FIGS. 3 AND 4.—SIDE AND END VIEWS OF THE AUTOMOBILE TROLLEY.

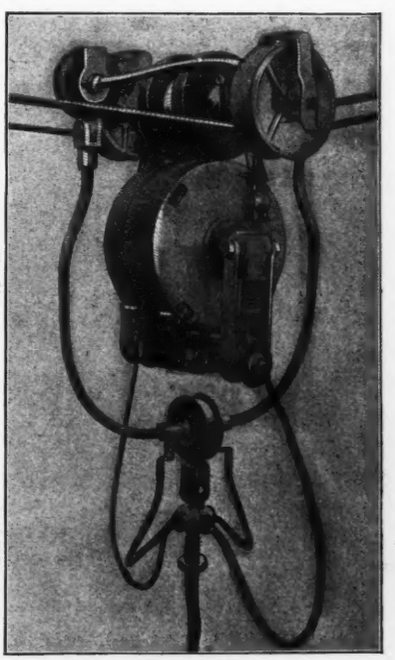


FIG. 5.—GENERAL VIEW OF THE AUTOMOBILE TROLLEY.

Figs. 3 and 4 are side and end views of the trolley, Fig. 5 a general view of the trolley, and Fig. 6 a diagram of the connection of the carriage to the trolley.

In the experimental installation the line is composed of two hard copper wires about No. 0 gauge, hung at the same level and between 20 and 30 feet above the ground and kept apart by their supporters at a distance of about one foot. The line is supported by special hangers which are well shown in Figs. 1 and 2. The trolley runs on top of the wires.

The trolley rests upon the wire by two rollers of aluminum which bring the currents to the carriage by means of the cable, 32 feet long, and composed of six conductors. Two of these of large section bring the current to the vehicle, and the other four govern the automobile trolley. The cable is attached to a post on the vehicle, of which the top is about 13 feet above the road level.

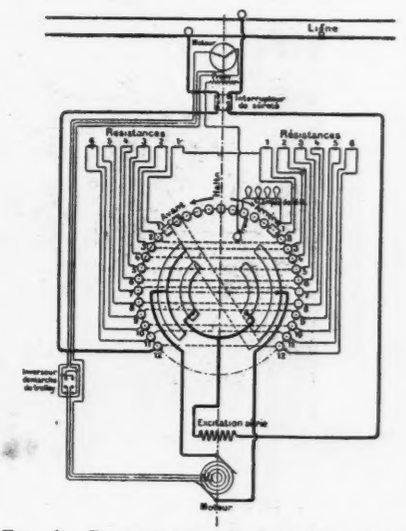


FIG. 6.—CONNECTIONS OF THE AUTOMOBILE TROLLEY.

The connection of the cable with the top of the pole is made through a six-contact plug arrangement and these are identical and interchangeable on all vehicles, so that in service two vehicles meeting one another can interchange their trolleys and pass without difficulty.

The organization of the Southern Ohio Traction Company, operating an electric railway system between Cincinnati and Dayton, a distance of 51 miles, has been accomplished by the final consolidation of the Cincinnati & Hamilton Electric Street Railway Company and the Cincinnati & Miami Valley Traction Company. Meetings of the shareholders of the two original companies were held and the formal ratification of the consolidation agreement made by the directors at Cleveland on January 22 was voted. The operation of through cars has begun, and the improvement of the tracks will be at once taken up. The entire route will be fitted with telephone connections, and its equipment will be made the most complete of all Ohio electric roads. Cleveland and Akron capital is largely interested in the big deal.

American Water-Power Electric Transmission Plants in Mexico.

The dry climate, the high price of fuel and the numerous mining and other installations requiring power found in the republic of Mexico, make that country one of the most promising fields for water-power and long-distance electric transmission enterprises that is known. Its mountains abound with fine water-powers, generally of the high-head variety, well adapted for the use of impulse water-wheels which are themselves especially adaptable for electric generator driving apparatus.

The illustrations shown with this article represent some engineering works of this character recently constructed by the Pelton Water-Wheel Company, of New York and San Francisco. At Portezuelo, near Puebla, is one of the largest plants of its sort in the republic. The station, which is 22 kilometres (14 miles) from the city of Puebla, was designed for four units, each consisting of one 750-kilowatt General Electric Company's three-phase generator, one exciter and one impulse wheel of the Pelton type, developing 1,200 horse-power. The units are direct-coupled and run at 300 revolutions per minute. At present two of them are installed and the other two will be put in in the near future. Fig. 1 shows one of these groups.

The water for operating this plant is conducted through a canal nine kilometres (5.6 miles) long upon which are nine tunnels. One of these, which is one and a half miles long, leads to the head of the pipe lines. There are to be two pipe lines, one of which is now installed. This is 40 inches in diameter and 2,558 feet long. It is built in 25 sections of riveted steel with angle flanges, the plates varying in thickness from three-sixteenths to seven-sixteenths inch. The wheels work under a head of 471 feet. Fig. 2 shows the head of the pipe line where the canal ends, while Fig. 3 shows the power house

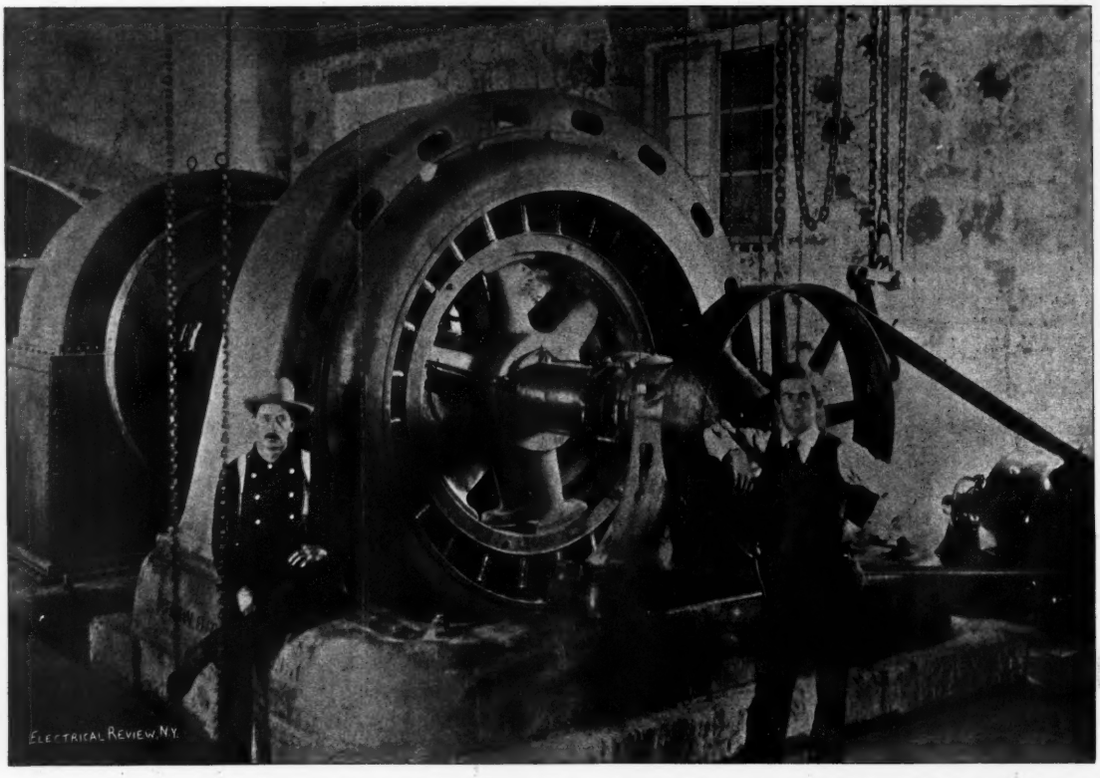


FIG. 1. ONE OF THE GENERATOR, WATER-WHEEL AND EXCITER UNITS IN THE STATION OF THE PORTEZUELO-PUEBLA TRANSMISSION LINE, MEXICO.

FIG. 2.—HEAD OF THE PIPE LINE, PORTEZUELO, MEXICO.

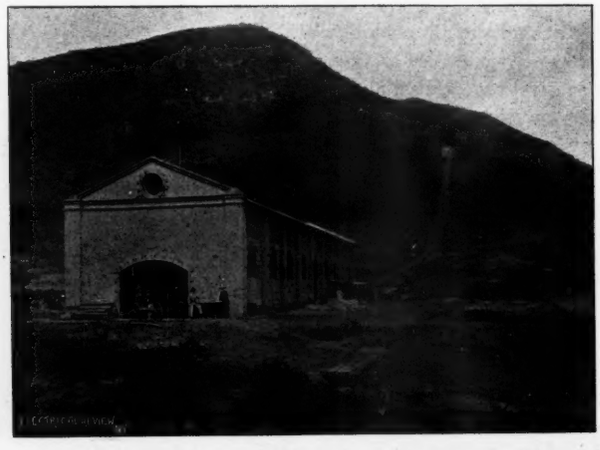


FIG. 3.—POWER-HOUSE AND PIPE LINE, PORTEZUELO, MEXICO.

at Portezuelo, with the pipe line coming down over the hill, in the background. The wheels in the station are 66 inches in diameter, fitted with steel buckets and run on a nine-inch hammered steel shaft.

The handsome illustrations show the solid and high-class work which has recently been installed in three plants in Mexico. They form in themselves an object lesson of the importance of the Mexican market for electrical manufactures and illustrate also in an admirable manner the progressive character of the work which is being done in our sister republic.

FIG. 4.—AMERICAN WATER-WHEELS AND DYNAMOS IN LA CUESTA STATION, SAN RAFAEL MILLS, MEXICO.

They are supplied with water through double nozzles giving two streams to each wheel, the diameter of the streams being variable up to 4.1 inches. To each nozzle is fitted a pair of bronze cut-off hoods which are worked through a system of levers by an electric relay governor. This station is now furnishing power for the electric lighting of the city of Puebla and for operating the machinery of several mills.

In the section of country near the transmission line between Portezuelo and Puebla are a large number of cotton mills, and it is expected that in the near future all, or most of them will be driven by electric power from this plant.

In addition to this plant the same company has installed several others in Mexico, among which may be mentioned that at the San Rafael Paper Mills. In this installation, which is well shown in Fig. 4, there are two wheels, each of 11 feet 2 inches diameter, working under a 980-foot head, and direct-coupled to 400-kilowatt Westinghouse three-phase generators running at 212 revolutions per minute, and there are also two five-foot wheels working under a 200-foot head, coupled to one 400-kilowatt three-phase generator running at the same speed. In the mills at San Ildefonso, an interior view of the plant being shown in Fig. 5, are also installed a number of these wheels direct-coupled to polyphase generators by which the power is distributed through the works.

FIG. 5.—AMERICAN WATER-WHEELS AND GENERATORS IN THE TLILAN STATION, SAN ILDEFONSO MILLS, MEXICO.

THE SUPPLY OF GUTTA-PERCHA.

DATA CONCERNING PACIFIC AND ATLANTIC CABLES—THE SOURCES OF SUPPLY—METHODS OF COLLECTING — GUTTA-PERCHA IN THE PHILIPPINES—THE DEMAND — ATTEMPTS AT CULTURE.

BY HAWTHORNE HILL.

The fact that a Pacific cable would require a greater amount of insulating material than any single submarine line that has yet been constructed has given the proposed enterprise an importance in some minds beyond its merits. For example, it has given rise to fears lest there should not be enough gutta-percha available for its construction. It is true that a cable 7,500 miles long, insulated at the rate of 400 pounds per mile, would require a great deal of gutta-percha, compared with the ordinary rate of production. The total would be about 1,500 tons. But in the years 1880, 1881 and 1882 there was laid down in the North Atlantic alone cables of an aggregate length of 7,782 miles, in the construction of which were used 942 tons of gutta-percha, to say nothing of many shorter lines of cable, including a total of over 3,000 miles for the Central and South American Telegraph Company. Yet all the gutta-percha required came forward as needed, the reported home consumption in England, where the cables were manufactured, rising from 27,700 hundredweight in 1898 to an average of 59,386 hundredweight for the three years above mentioned. Later, in 1886, the home consumption fell to 29,169 hundredweight. As for prices, the average value of gutta-percha imported into Great Britain was officially stated at 20.4 pence (for good, bad and indifferent) in 1878. By 1882, despite the largely increased requirements, it had fallen to 15.1 pence per pound, after which, for some time, there was a continued decline. All of which proves only that in the past exceptional requirements have resulted neither in exhaustion of supplies nor in an advance in prices to a prohibitive level.

It may as well be admitted, however, that the gutta-percha situation leaves much to be learned. It is often heard that the supply is becoming exhausted. In 1844 two tons of gutta-percha were exported from Singapore, and it at once met such a demand in Europe as to stimulate its collection at a rate which, four years later, had almost denuded the islands of the species; a botanist reported that he was unable to find there a specimen of the tree for study. There was a temporary falling off in production, and the same thing has happened since in other localities where gutta-percha has been discovered. New sources have continued to be found, however, and it is doubtful if the man lives who can fix a limit to the natural supplies of this commodity. The prevalent method of collecting gutta-percha is by felling the trees and extracting the gum contained in the bark from the base to the topmost branches. But while individual trees are destroyed, the forests remain, and such trees as are too small to tempt the collectors to-dav, in the course of a few years become large enough to produce gutta-percha.

It was just before 1880, by the way, that Europe experienced a widespread fear of the impending scarcity of gutta-percha, which led to several commissions being organized—especially by France and Holland—to seek new sources of supply and to study the possibilities of producing the gum by forming plantations. Nothing practical resulted beyond putting on record more definite knowledge than had existed before. But it may be inferred that one cause of the decline in interest in this subject was the fact that gutta-percha has continued to come forward as required, the supply practically being equal to the demand.

The prices of gutta-percha quoted in the European markets, or even at Singapore, are not to be considered as representing its cost to the cable construction companies. When a new important cable is planned, the intending contractors, no doubt, send out agents to buy up secretly whatever material may be required, and their holdings, thus obtained, may never appear in any published statistics of gutta-percha stocks. One of the great English companies which, a few years ago, at the invitation of the British government, tendered for the construction of a proposed Pacific cable, in their latest published balance sheet, report as part of their assets several hundred thousand pounds sterling worth of material on hand. It is safe to infer that gutta-percha figures in this account to an important extent; also that this company is not alone in this respect, no less than six British cable-making companies having tendered for the cable in question. Such details all have a bearing upon the theory that there is not enough gutta-percha in sight to build another ocean cable.

While less gutta-percha has been coming forward for a few years past than during the periods of greatest activity in ocean cable construction, this fact alone does not prove the exhaustion of the sources of supply. The receipts from the Malay peninsula have continued at about the same rate for many years; those from Java and Sumatra have declined one-half in a like period; and those from Borneo have increased largely. Borneo, the least-known and explored of these various regions, meanwhile has been the scene of much new development, as a result of which largely more of its area is accessible now than was the case a dozen or twenty years ago, and if the districts now being explored should be found to contain gutta-percha, as it now seems reasonable to believe, the result must be a continued increase in the output of the material. Already a railway is being constructed in British North Borneo, induced in part by the desirability of penetrating further into the gutta-percha producing regions, and one of the great Eastern cable companies, as a partial return for connecting the islands of Labuan and Borneo with a link of its system, has obtained a concession for a large tract of land which they regard of value on account of the gutta-percha to be obtained from it.

The belief prevails in some quarters that gutta-percha exists in the Philippine archipelago, though the conditions favorable to its occurrence, as laid down by so able an authority as the late Dr. Obach, do not lend much strength to this belief.

It is not merely a new ocean cable now and then that makes a demand for submarine insulation; the aggregate of the short deep-sea cables scattered throughout the world is far greater than the total length of the lines which span oceans. Moreover, the demand all this while for gutta-percha in cable work has been in the construction of new lines, but since the best of work will wear out, the time must come when this material will be required for replacing old cables as well as for still more new ones. Recent successes with india-rubber for deep-sea insulation may lead to its wide use as a substitute for gutta-percha, for the shorter lengths of cable, even if capitalists and engineers should hesitate to embark in the laying of single india-rubber cables at a cost of millions. One other consideration is that experiments in the planting of india-rubber, though not advanced sufficiently to have developed practical culture, yet point to success at a period in advance of the exhaustion of the native rubber supplies. There is no reason apparent as yet why equally good results should not follow the more limited experiments with gutta-percha now in progress in the bo-botanical gardens at Buitenzorg and elsewhere.

ELECTRICAL PROGRESS IN ITALY DURING 1899.

BY ENRICO BIGNAMI.

Among the various diverse indications of progress during the year that has just closed the most eloquent were the exposition in commemoration of the centennial of Volta, at Como, and the bulletins of commercial bodies frequently announcing the incorporation or extension of companies for this, that or the other electrotechnical application.

Although it was destroyed by conflagration before it was entirely completed, the Electrical Exposition at Como, in which more than two hundred Italian concerns participated, formed a luminous proof of the rapid advance which the constructors of dynamos and accessories have made in the space of less than a year since the last exposition, at Turin.

Notwithstanding the relatively large number of exhibitors—of which no small number were for the first time exhibiting at an international exposition—but few of the Italian houses showed dynamos and motors; but the number of machines exhibited by these few was more than 200, ranging from the little motors of one-eighth horse-power to alternators of 500 horse-power. And not a few won diplomas and medals which the jury allotted to them on account of their workmanship, accuracy and efficacy.

Several individual exhibits were honored in this manner with diplomas, among which first in quality was that of Professor Riccardo Arnó—the worthy collaborator of the late distinguished Galileo Ferraris—who showed the following apparatus which, like nearly all the others, was destroyed by the fire:

Two-phase rotating electric field—rotation due to the lag of polarity of the dielectric.

Three-phase rotating electric field.

Electrostatic motor with rotating electrostatic fields.

Apparatus for the measurement of the dissipation of energy in the dielectric under the action of a rotating magnetic field.

Electrostatic rotation of rarefied gases.

Kilovoltmeter with rotating electrical field.

Ground detector for three-phase high-tension system.

Tangent phase-meter.

Apparatus for the simultaneous measurement of power and power-factor.

A non-synchronous motor for single-phase current—the Arnó starting system.

Ferraris-Arnó phase-transformer.

Two-phase motor with variable speed, fed from a single-phase circuit.

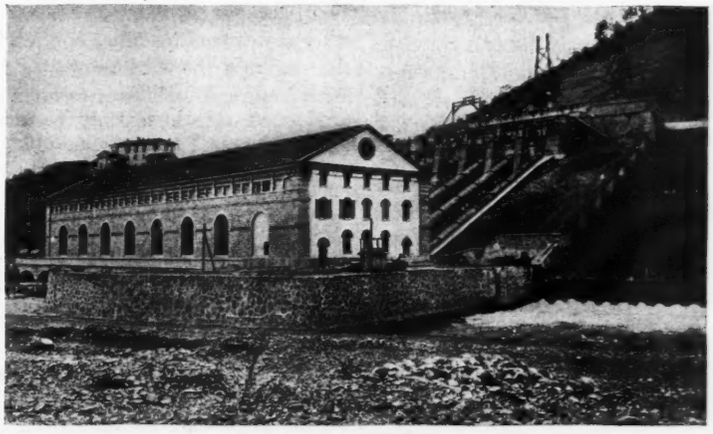
Two-pole fixture for surface contact electric traction system.

Professor Arnó has also patented a meter for three-phase plants of marvelous simplicity and unparalleled exactness, and had the good fortune to see his system for starting single-phase induction motors adopted by several Italian and foreign concerns.

A diploma of honor was also given to Professor L. Lombardi, of the Industrial Museum, in Turin, for his studies and specimens of condensers for commercial systems. A similar one was also conferred on Signor L. Magrini for his system of automatic regulators for the charge of a battery of accumulators during their operation without parallel distribution or the intervention of current-consuming apparatus.

During the exhibition there took place (as was promised by the Italian Electro-Technical Association, which held itself eight sessions with about 700 members present) the National Congress of Electricians, a notable gathering, both for the importance of the questions discussed, for the number of delegates present, and for the sympathetic interest of the best class of physicists, both Italian and foreign, in honoring the memory of Alessandro Volta. There were also held the initial meetings of the old and well-known Societa di Fisica and the first National Congress of Telegraphers, which brought together notable people from all quarters.

As has been said before, the entrance of new firms into the electrical industry during the last year is not the only manifestation of its vigorous development. This would have been easy to foresee from the continued increase during preceding years and from the relative importance of the invested capital, now a total of about 3,000,000 lire ($600,000). The majority of the investment is in the shape of stock companies, this method of organization seeming to meet with the approval of the financial powers better than any other. When financial ability is accompanied by technical competence the result will be that the concern will take a strong place in the competitive field. The foreign houses have also continued to install Italian sub-offices; for example, Siemens & Halske, and the Aktien Elektricitäts Ge-



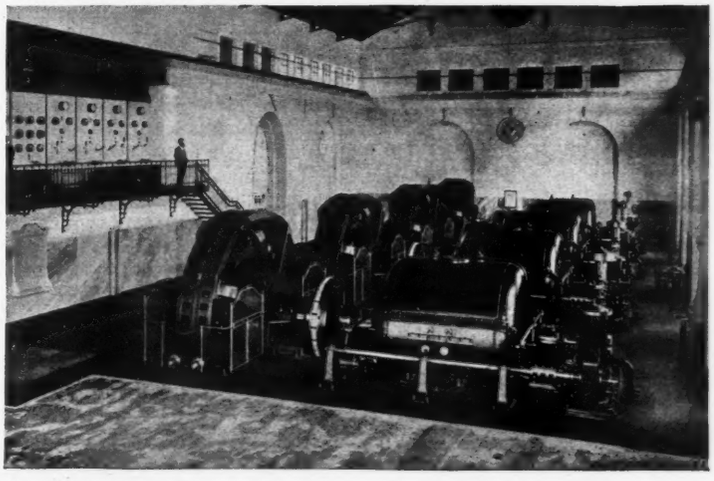


FIG. 1.—THE MILAN-PADERNO TRANSMISSION—EXTERIOR VIEW OF POWER HOUSE, PENSTOCKS AND WASTE-WEIR.

FIG. 2.—INTERIOR OF POWER HOUSE, SHOWING TURBINES, DYNAMOS AND SWITCHBOARD GALLERY.

sellschaft, of Berlin. In 1899, the Thomson-Houston Company, of Milan, the Alioth Company, of Rome, and the Helios Company, of Geneva, were incorporated. The companies formed in part with Italian capital and in part with foreign capital are quite numerous, especially in the direction of operating concerns for electric traction on tram roads and light railways. Not less numerous are the projects and undertakings in course or formation of which the weekly press brings us accounts.

A tendency, noticeable both on the part of the government and of the great railway companies, to apply electric traction still further to important railways, makes it evident that in this field especially will be found an opportunity for engineers, construction concerns and capitalists. Toward this end the present concerns have commenced to combine among themselves and the Association for the Advancement of Electrical Enterprise in Italy has already 40 members among the more important of them.

The first experiment on electric traction through a much frequented thoroughfare—the Milan-Monza line—was accomplished with a few accumulator cars, but the results, speaking from an economical point of view, did not seem encouraging, seeing that the car could carry at most only 90 passengers and weighed about 53 tons, about 17 of which represent the weight of accumulators. The company controlling the tramways of Turin and of Rome, which had adopted accumulator cars for a few of its lines, has recently requested of the administrations of those cities the privilege of substituting the trolley system. Work is soon to be begun upon the application of electric traction to a line of more than 100 kilometres in length (62 miles), from Lecco through Sondrio to Chiavenna, under the plans of Messrs. Ganz & Company, of Budapest. Since three other lines are being transformed to the electrical system by the Thomson-Houston Company it seems that the government has definitely approved projects of this character.

Power transmission plants have continued to increase in number and size in all parts of Italy. The most important that is soon to be built is that called the "Vizzola sul Ticino," in Lombardi. The power house will contain, when completed, 10 generating groups, each formed of a 2,000-horse-power turbine and a three-phase dynamo of corresponding capacity direct-coupled thereto. At the present time there have been put in operation only seven of these groups. There will be, in addition, two other units of smaller size, generating direct-current, however, for the separate excitation of the great generators and for all the services of the plant—illumination, electric cranes, the manipulation of water-gates, etc. The turbines were furnished by the Milan concern, Riva Monneret e Cia. The electrical material came from the well-known Nuernberg concern, the Aktien Gesellschaft, formerly Schuckert & Company. Current is generated directly in the dynamos at a pressure of 11,000 volts in each phase and at a frequency of 50 cycles per second. There are many other new plants for other applications of electricity in the arts, especially for the manufacture of carbide of calcium, in the production of which Italy occupies the fourth place. There is some talk now of the establishment of a great plant for the manufacture of caustic soda by electrolysis. A certain development has taken place in inter-urban telephony, and now that the government has decided to undertake the passage of a complete schedule of laws for plants and administration of the principal lines, with an appropriation for this purpose of 2,000,000 lire ($400,000), there is some hope that the desired network of long-distance lines between the larger centres of trade will be put up—those between these centres and the little towns, which were the product of private enterprise, were very quickly built when it was seen that they were needed.

Of telegraphy without wires there is naturally much talk with us since the lucky inventor is our fellow-citizen, the Bolognese Marconi, but up to now there has not been made, except for certain experiments at schools, any tests save those at Spezzia. There is also very much talk at present of the inventions of another Italian, Signor Guarini Foresio, who is at present engaged in forming a company at Brussels for the exploitation of his patents upon a repeater for wireless telegraphy. There is also much interest felt in the invention of Professor Mario Russo d'Azar, another Italian, for wireless telephony, with which recent experiments between two trains under way were undertaken with results that are said to have been excellent.

To conclude this rapid survey of the progress of electro-technics in Italy during the last year, let me state that the special courses in electricity instituted lately in the high-grade schools of Milan, of Turin, etc., were much more largely attended and appreciated than ever before, that not a few such courses were inaugurated in industrial schools by private initiation, and that it will not be long before Italian students can find in these institutions the opportunity to complete their studies in electricity without being obliged to go, as formerly, to the institutions at Liége, in Belgium, or London.

On the preceding page is an illustration of one of the finest power-transmission plants in Italy; this is of special interest in connection with Signor Bignami's article.

The Remarkable Brush Lights Which Emanate From Kite-Sustained Wire.

To the Editor of Electrical Review:

The high voltage of atmospheric electricity, with which I am working by means of kites, results in a remarkable display of brush light at night from every splice which has been made in the wire. With my improved steel wire kite cable—the wire is somewhat finer than a knitting needle, being No. 23 gauge—I can, with one kite either six or seven feet in diameter, readily reach a height of 1,000 feet with the bare wire and in a very few minutes. I have found the most satisfactory time for these experiments to be at night, because then the winds are more stable, and the brush lights and sparks emanating from the wire can be more readily seen. The steel wire after the kite has carried it to a considerable height becomes charged with positive electricity, which accumulates with increasing intensity because the wire is wound on the wooden drum of a reel with a steel shaft for a core. The bare wire is wound on the revolving wooden spool, which is insulated from the earth by its wooden supporting box, the drum forming a Leyden jar condenser. I find that when the kites are aloft the largest sparks are drawn from the steel shaft forming the core of the wooden drum of the reel.

The striking brush light effects are observed at the various points where the wire is spliced, the splicing resulting in sharp points. The splice is like that in use by telegraph linemen. There are probably more than 50 such splices in the bare wire between the earth and my flying kite aloft, and I believe every one emits a brush light when the wire is fully charged. Of course I am unable to see the brush lights aloft because of distance and the faintness of the light, which, however, becomes more vivid at the earth if a grounded iron rod is made to approach the spliced wire.

The reel-drum spark-coil causes such a stream of sparks across a three-eighth-inch spark gap sent aloft that an arc light of mild candle-power is produced. At night the phosphorescent-like glow of the brush light breaks and crackles into sparks if the iron grounding rod is made to approach the charged wire.

This atmospheric electricity has little motive power, and scarcely any magnetic effect. I have a very small electric motor which runs with one Leclanche cell, but the sky electricity has so little magnetic power that the motor will not stir even when subjected to possibly millions of volts of high tension static electricity. I am slowly intensifying the arc light without a dynamo or battery and using only that vast condenser, the charged layers of the upper air in clear or cloudy conditions.

William A. Eddy.

Bayonne, N. J., February 23.

THE STATUS OF THE ELECTRICAL INDUSTRY IN SOUTH AMERICA.

THE OPPORTUNITIES AFFORDED AMERICANS IN CONNECTION WITH ITS FURTHER DEVELOPMENT.

BY CHARLES P. KING.

The first use of electricity as a light and for motive purposes in the countries lying south of the United States in this hemisphere is of quite recent date, it being but a few years ago that electric lighting, street railways, power, etc., were unknown south of Mexico. At present, however, nearly all of the large towns and cities of the South American republics are either lighted by electricity or have the project under consideration. Many of the tramway companies, especially in the capitals and coast cities, have changed their "burro" traction lines to the electric system; others are projected and companies are being formed to construct new lines everywhere.

Many of these companies are composed of American capitalists, especially in Costa Rica, Colombia, North Brazil and Argentina, but the majority of the foreign companies are English and German, with here and there a French or Belgian company. English and German capitalists are particularly keen in securing and working concessions for electric roads and light plants in Argentina. In Demerara, British Guiana and Sao Paulo, Brazil, Canadian companies are now constructing electric street railways. Sir William Van Horne, ex-president of the Canadian Pacific Railway Company, and located at Montreal, Quebec, is largely interested in both these companies.

It may therefore be stated that the leading commercial nations of the world are investing capital in the development of the electrical industry in South America, and it behooves Americans to give an ever increasing degree of attention to the opportunities that are offered and will continue to offer themselves for the very remunerative investment of capital and labor in electrical enterprises in these republics. Argentina, Brazil and Chili are the most advanced in electrical work as they are the largest, most progressive and most populous of the South American republics. Uruguay, Peru and Venezuela may be said to come next in order of electrical development, while the British and French Guianas, Ecuador, Costa Rica, Colombia, Nicaragua, Honduras, Paraguay, Bolivia, San Salvador and Dutch Guiana follow in the order named, although in the case of the last few it can not be said that they have so far made much progress in this direction beyond the installation of lighting plants in their chief cities. However, this is due to a lack of capital and not to a lack of desire for these improvements; and right here is where Americans desirous of profitably investing their time and money should step in.

In order to show the American manufacturers of electrical materials and machinery the profitable markets that are open to them, and the already important trade that is carried on in Argentina, Brazil, Chili, Uruguay and Peru, a review of the work completed, under way and projected in those countries is here given:

ARGENTINA.

In this country electrical work has, inside of the last five years, advanced to a greater degree than in any of its sister South American republics. Since 1895 the increase in the use of electricity as a motive power and for lighting purposes throughout the entire country has been remarkable.

The first use of electricity for traction purposes was made by the Buenos Aires and Belgrano Tramway Company, on its tram line in the city of Buenos Aires, on April 22, 1897, when the first electric car ever operated in Argentina was sent over its system. This line was installed by Charles Bright & Company, now the Bright Electric Light and Power Company, Limited, with a capital of $1,000,000, gold, the largest electrical engineers and contractors in Argentina, and most of the material employed came from the General Electric Company, of New York.

The "La Capital Tramway Company," of Buenos Aires (an American Company), was the second company to complete an electric tramway in the country and this road was opened to the public on December 4, 1897. The steel power house, the rolling stock, the machinery, rails and overhead appliances for this road were all furnished by American manufacturers. Since the construction of these two lines many others in Buenos Aires, Rosario, Cordoba and other parts of the country have been built; others have altered their systems and many are now projected to be built or altered. Senor Antonio P. de Alen, of 733 Avenida de Mayo, Buenos Aires, has recently received permission from the municipality of that city to alter the motive power on a network of tramways, for which he holds the concessions, from steam to electricity.

The Anglo-Argentine Tramway Company, offices at Calle Rivadavia, 3583, Buenos Aires, have just decided to change their system to that of electric traction and have presented a petition to the municipality for the necessary permission.

Charles Bright, Calle Reconquista, 80, Buenos Aires, has just received a concession for the construction of an underground electric railway from the Plaza Constitucion (the centre of the city) to Retiro (in the suburbs), from Chacarita to the Docks, etc., and will no doubt soon commence its construction, and it is reported that Mr. Bright has already arranged the matter of capital in London.

Messrs. Miranda Beyer & Company, Calle Almagro, Buenos Aires, also have a concession for, and will construct, an electric street railway in Buenos Aires.

Messrs. Peacock & Company, of Calle San Martin, 782, and Senor Jorge G. Killey, of Calle Lavalle, 805, will also build lines in Buenos Aires in the near future.

In Rosario, Messrs. Maximo P. Bavio & Company, at the head of a London company with a capital of $2,500,000, purchased in January the Anglo-Argentine, Ciudad de Rosaro, Rosarino del Norte and Oeste Tramways, of Rosario, and are now applying to the municipality of that city for leave to change the system to that of electric traction. The Parana municipality are now negotiating with Messrs. Maximo P. Bavio & Company for the electric lighting of their city. With all of the above mentioned parties it would be highly advisable for the American manufacturers of the materials that will be required for these projects to open up communication. The American manufacturers already secure a large share of the electrical trade of Argentina, but a much larger share could be secured were more attention paid to the trade.

In 1895 Argentina's imports of dynamos, galvanized iron wire (exclusive of fence wire), electric light, cable and wire, incandescent lamps, other electrical apparatus, materials for telephones and telegraphs, carbons, motors, etc., amounted to $625,814, gold; in 1896 it had increased to $1,319,220; in 1897 to $1,916,435, and in 1898 to $3,273,638. The following import statistics will, however, best show the quantity of the trade by each of the competing nations:

	1895.	1896	1897.	1898.
Germany	$131,919	$467,991	$428,187	$ 802,799
Belgium	256,884	284,921	417,917	1,063,917
United Kingdom	126,972	290,714	45[illegible]958	205,3[illegible]6
United States	91,318	258,403	560,161	826,976
France	18,456	12,962	22,542	34,225
Italy	5,316	4,234	36,470	40,057

Imports from the United States have,

as can be seen, increased to an enormous extent during the last few years, and American firms are now supplying the greater percentage of electric light materials, incandescent lamps, carbons, etc., that are entering the country. The figures showing the imports from Belgium in 1898 are larger than those of any other country, but this is explained by the large quantity of wire for the conducting of electricity that was imported ($718,049 worth) from Belgium in that year. The German manufacturers are the greatest competitors of the United States in this country and in addition to establishing branch houses in Buenos Aires and elsewhere for the sale of their materials and machinery, the leading German electrical firms have formed companies for operation in Argentina which have either erected or acquired electric light and power stations and tramways, which they have converted in various parts of the country. The German Electric Light and Traction Company, formed in June, 1898, in Buenos Aires, with a capital of $5,000,000, gold, is the most aggressive of these German companies. This company immediately purchased outright the old horse-car lines of the Metropolitan and Grand National Tramways companies, in Buenos Aires, and altered them to electric lines. In Rosario, Cordoba, Salto, Brigada, San Fernando and elsewhere they have established electric light and power plants, and they are constantly reaching out for new opportunities. The River Plate Electric Light and Traction Company, an English company, has the most complete central station (9,600 horse-power and electrical capacity of 6,000 kilowatts) in South America, as well as smaller stations in Rosario, Tucuman, La Plata, etc., and is the greatest competitor of the big German company. This company, in addition to supplying light and power from its stations, also installs complete plants for private lighting and traction companies and the most of the machinery installed by it is of American manufacture, so that it is to be hoped in the interests of the American manufacturer that the German companies (who only install German machinery) will not be able to best the English concerns now operating in the republic.

The "Cie Generale d'Electricite de la Ville de Buenos Aires" (capitalized at 6,000,000 francs), is a large French lighting company which is also making active warfare against the English but not to the same extent as the German companies. The Primitiva Gas and Electric Light Company is another large English concern which largely employs American machinery and materials. An American company which is operating here is the "South American Electric Company, Limited," which was formed in the early part of last year by the General Electric Company, of New York, and Charles Bright, of Buenos Aires, with a capital of $500,000. The General Electric Company now have a branch office in Buenos Aires where a supply of the materials and machinery it manufactures is kept on sale.

Messrs. Vieyra & Gastre, of Calle 25 de Mayo, 130 Buenos Aires, have presented a scheme to the municipality for the public lighting of the entire city by electricity for a period of 10 years. Should their project be favorably received they will construct immediately a large light and power station in the central portion of the city.

It is reported that the municipality looks with favor upon their application, although a decision may not be made for some months, yet as the question of a municipal plant is again being agitated, Mr. Carlos R. Thursby, of "La Capital Tramway Company," Calle Reconquista, 20, Buenos Aires, recently received concessions from the town of Bahia Blanca to install a system of electric tramways and to illumine that city by 60 arc lamps of 1,200 candle-power each, to be followed by incandescent lighting, and this work is now being carried out by them. At Azul a Mr. Luis Dhers (one of the leading millers in Argentina), in November last obtained a concession for the electric lighting of that town and is now engaged in erecting an electric light and power station.

In addition to the parties named above, the following firms or individuals are prominently identified with the electrical industry in Argentina:

Buenos Aires: Pablo Fontan & Company, Cuyo 890; A. Goubet, branch of a house in Louvain, Belgium; Agar Cross & Company, Calle Defensa, 124-136; Griet Hermanos, Calle Florida, 537; Bailey, Walker & Company, Cuyo, 454; Thomas Drysdale & Company, Calle Moreno, 436-76; Geiger de Bary & Company, Calle Reconquista, 146; Bartram & Ball, Avenida de Mayo, 630; Ciriburi & Company, Calle Parana, 1047; "Cia. General de Electricidad de la Ciudad de Buenos Aires," Cuyo 763; "Cia. de Luz Electrica y traction del Rio de la Plata," Calle Esmeralda, 173; "Cia. Alemana Transatlantica de Electricidad," Calle Florida, 723-35; J. Collonges, Calle Maipu, 542; R. Broman, Calle Moreno, 1213; Juan D. Fitt, Calle Moreno, 834; Carlos Schilder, Calle Lavalle, 1019-25; Rufina Varela, Calle Florida, 259; Otto Straube, Calle Cangallo, 1701; Carlos Hassler, Calle Belgrano, 525; Guidui Luis, Calle Charcas, 1034; Schniffner & Company, Calle Belgrano, esquina Peru; Edmundo Le Roy de Bonneville, Calle Defensa, 740.

Rosario: Angel Montes, Calle San Martin, 779; Ohe & Peterson, Calle Lorenzo, 1262.

Note—Since writing the above, advices have been received to the effect that the "River Plate Electric Light and Traction Company, Limited," has passed into the hands of a receiver.

URUGUAY.

Although Uruguay has not been at all slow in adopting the electric light, very little progress was made introducing electric traction until quite recently. Electric lighting plants have been established in the leading industrial mills, not only in Montevideo, but throughout the interior, but very few of the smaller towns of the interior have light plants as yet. However quite a number of the municipalities are investigating the cost of this system of lighting and some have signified their intention to have such installed. In Montevideo the municipality have just resolved to accept the proposal of Mr. Colladon for converting all the horse tramways of the city into electric and the work will now soon be commenced. The Germans, Americans and English supply the majority of the electrical machinery and materials imported, although the trade has not as yet assumed very large proportions.

The following firms in Montevideo import and install electric light and power machinery:

Eugenio Barth & Company, Calle 25 de Mayo, 490; Guillermo A. Harley, Calle Colon, 45-47; Ernesto Quinspe, Calle Cerro Largo, 90-92.

BRAZIL.

The electrical goods trade of Brazil on the Amazon and in the cities within 100 miles of the coast along its entire length is growing by leaps and bounds.

In Para (the population of which has doubled in the last four years), situated about 100 miles from the mouth of the Amazon River, and which is the key to an enormous stretch of wealthy country, street railway lines (not electric) run in all directions, and the telephone and electric lights are to be found on all sides. The principal electric lighting company is the Companhia Luz Electrica Urbana, of which Senor Lucio Freitas do Amaral is the general manager. Three triple expansion engines of 400 horse-power each and one vertical compound condensing engine of 600 horse-power are used. The electrical machinery was purchased in Germany. Although the company seems to favor Germany in the purchasing of supplies, it might be well for American manufacturers to correspond with the general manager either in Portuguese or French.

(Concluded next week.)

ANTI-BELL COMPANY PURCHASES THE ERIE TELEPHONE SYSTEM.

THE TELEPHONE, TELEGRAPH AND CABLE COMPANY OF AMERICA THE NEW OWNER—INTERVIEWS WITH PRESIDENTS GLIDDEN AND LATTA.

It was briefly announced in the ELECTRICAL REVIEW last week that the Erie Telegraph and Telephone Company, of Lowell, Mass., had been purchased by the new telephone company of New York city, organized to own and operate independent telephone companies. The Telephone, Telegraph and Cable Company of America is the name of the new company, which was organized last October with a capital of $30,000,000. Mr. W. J. Latta, a prominent railroad official of Philadelphia, is the president of the company, and a number of capitalists of New York and Philadelphia are interested.

By the purchase of the Erie, the new company controls the largest Bell system under one management, taking over five companies, licensed by the American Bell Telephone Company. These operate in Cuyahoga County. Ohio (which includes the city of Cleveland), and in the states of Texas, Arkansas, Michigan, Wisconsin, Minnesota, South Dakota and North Dakota. The Erie system comprises 115,000 telephone subscribers, about one-sixth of the entire number heretofore in the Bell fold.

President Charles J. Glidden, of the Erie, stated to a representative of the ELECTRICAL REVIEW last week that "the report is true that the Telephone, Telegraph and Cable Company of America has purchased 50,001 shares, par value, $5,000,100, out of a total issue of 100,000 shares, par value, $10,000,000, of the capital stock of the Erie Telegraph and Telephone Company. The purchasing company is one of the strongest combinations in the country and will probably be the largest owner of electrical properties in the United States when its plans are fully developed. The transaction is the largest known in telephone circles.

"The American Bell Telephone people could have secured a controlling interest in the Erie before the new owners had accumulated much of any stock, but they did not avail themselves of the opportunity"

"How will the change affect the Erie and its Bell relations?" was asked.

"The position of the Erie in the telephone field," replied Mr. Glidden, "is strengthened to a remarkable degree. All the sub-companies of the Erie system operate under perpetual contracts with the American Bell Telephone Company and have the full benefit and use of all the patents owned and controlled by the Bell people, together with the long-distance connections, while the owners of the controlling interest in the Erie will certainly discourage and prevent any independent company invading the Erie territory."

Mr. Glidden will continue as president of the Erie at the request of the new board. The policy of the Erie, it is stated, will not be antagonistic to the contracts existing between the Bell Company and the Erie sub-companies, in which the Bell Company owns minority interests. Several additional directors enter the board of the Erie, including Charles E. Adams, of Lowell, who becomes vice-president, John Jacob Astor, W. J. Latta and Martin Malony.

The Boston *News Bureau,* a financial journal, says:

"The new names on the board look like Western Union interests, but the Bell Telephone people presumably know where they stand. It is passing strange, however, that the Bell Telephone Company, after reversing its policy of some years ago and buying back the control of territories it had disposed of in its early days, should have let the great sections represented by the Erie Company pass from its control.

"It is clear that the Western Union is in no condition to compete with the allied Bell telephone interests of this country. The allied telephone interests are in far better shape to enter the telegraph field and almost at a moment's notice."

President W. J. Latta was seen on the day of the transfer of the control of the Erie to his company by a representative of the ELECTRICAL REVIEW and confirmed the statement that the new board would operate the Erie system in harmony with its present relations and continue to extend its business in its particular territory. Mr. Latta said:

"As far as we know the Bell people do not own a single share of stock in the Erie Company; but their arrangements with the subsidiary companies, whereby the latter are entitled to use the patents of the Bell Company in perpetuity, are such that the Bell Company has a small percentage of control in each and is represented on the board of each by one or more directors. In accordance with the terms of the contract the Bell Company agrees never to enter the territory of the contracting companies. In that sense we have become allies of the Erie Company."

The extent to which the two big telegraph companies—the Western Union and the Postal—are interested in these developments is not yet evident. There are directors on the board of the Telephone Company of America who are on the board of the Western Union, and President A. B. Chandler, of the Postal Telegraph-Cable Company, is a director of the Erie, in which company John W. Mackay is said to own some 2,500 shares.

The minority interests owned by the American Bell Telephone Company in the subsidiary Erie companies (which now pass under the management of the opposition) is as follows:

Cleveland Telephone Company; stock issued, $2,400,000; Bell owns 29.17 per cent. Northwestern Telephone Exchange Company; stock issued, $3,700,000; Bell owns 21.09 per cent. Southwestern Telephone and Telegraph Company; stock issued, $4,429,000; Bell owns 30 per cent. Michigan Telephone Company; $2,500,000 capital stock and $2,785,000 bonds; Bell owns 4.4 per cent; capital of this company recently doubled. Wisconsin Telephone Company; capital stock authorized, $3,000,000; Bell owns 45 per cent.

It will be seen from the foregoing that the average interest of the Bell Company in these five organizations is slightly under 26 per cent.

Wall Street and the Electrical Stock Market.

The main influence in the stock market last week was the appointment of a receiver for the Third Avenue Railroad Company, which acted as a relief to the speculative situation. Such an issue of the company's affairs had been expected. The financial situation and the outlook are both inherently strong and encouraging. The market closed the week active and lower.

On the New York Stock Exchange, General Electric closed the week at 125 bid and 126 asked, a loss of 2 points for the week. Metropolitan Street Railway, of New York, closed at 168 bid and 168½ asked, a loss of 6 points for the week. Third Avenue Railroad, of New York, closed the week at 55 bid and 55⅜ asked, a loss of 20 points for the week. This stock reached 47 during the week. Brooklyn Rapid Transit closed at 67½ bid and 67¾ asked, a loss of 2 points for the week. Manhattan Railway, of New York, closed at 94⅛ bid and 94⅜ asked, a loss of 1⅞ points for the week.

On the Boston Exchange, American Bell Telephone closed at 318 bid and 319 asked, a loss of 11 points for the week. Erie Telephone closed at 109 bid and 111 asked, a loss of 8½ points for the week.

On the Philadelphia Exchange, Electric Storage Battery closed at 80 bid and 91 asked, indicating no change for the week. Union Traction closed at 36½ bid and 36⅝ asked, a loss of ⅞ point for the week. Electric Company of America closed at 12⅜ bid and 12½ asked, a loss of 1⅛ points for the week.

On the curb or outside market in New York, Electric Vehicle closed the week at 36½ bid and 40 asked, a loss of 4 points for the week. Electric Boat closed at 15 bid and 16 asked, a loss of 2 points for the week. Electric Axle was not quoted.

Wall street, March 3.

SCIENCE BREVITIES

Roentgen and Becquerel Rays—It has been somewhat hastily assumed by a number of physicists that the radiation of the Roentgen tube and the radiation of uranium, thorium and "polonium" compounds are identical in nature and differ only in intensity, says an *Electrician* abstract. The magnetic deflection of Becquerel-rays may now be said to be definitely proved. Further points of difference will probably appear as our acquaintance with the two forms of radiation becomes closer. B. Walter brings out in a striking manner the fact that there are considerable differences in the absorption and diffusion of the two types of rays. One of the most striking of the author's experiments is that of cutting two holes in a plate of lead and covering them with a layer of graphite four millimetres thick and a 0.07 millimetre platinum sheet respectively. To the Roentgen-rays the graphite is quite transparent, while the platinum intercepts them to a great extent. On exposing the same combination to Becquerel-rays from one of Giesel's preparations, the platinum appears more transparent than the graphite. In fact, to obtain equal absorption the graphite would have to be 50 times as thick in the case of the Roentgen-rays. The strong diffusion of Becquerel-rays by air and by bodies of small atomic weight renders them unfit for surgical use.

Constant-Current Transmission—At the Societe Internationale des Electriciens on the 10th ult., Mr. Cuenod read a paper on the transmission of power to great distances by means of the continuous-current series system. The paper was nominally a description of the work which has been done by Mr. Thury in transmitting energy on the series system, and the author gave comparisons between the cost of working of this system and the cost of working a transmission with alternating currents. He estimated that the cost of energy to the consumer should not be more than £4 to £6 per horse-power per annum, and that the first cost of the installation should not be more than £40 per horse-power. He stated also that the efficiency of the dynamos and motors was at least equal to that of the best alternators, that the series system does away with the use of transformers, and the line does not present any induction troubles. He estimates the economies arising in consequence of the above to be from 15 to 20 per cent. The brief *resume* of this paper which appears does not give full details of the author's estimates, but in the opinion of the London *Electrical Engineer,* he evidently neglected to point out the faults of the series system in that the high voltage is brought on to the consumers premises, and also that a fault in one consumer's apparatus may cause an interruption to the supply of other motors connected in series with this consumer. Mr. Thury was present, and in the discussion stated that he had used voltages up to 12,000 at present, but that he saw no difficulty in going as high as 22,000 volts.

The Molecular Weight of Sulphur—The true molecular weight of sulphur in the gaseous states have been made the subject of numerous researches. Herren O. Bleier and L. Kohn give an account of their work on the density of sulphur vapor at very low pressures. They hoped to be able to make determinations at such a low pressure that there would be no dissociation, but even for a pressure of 2.1 millimetres of mercury the found molecular weight was 251 instead of 256, corresponding to S_8. The result obtained, plotted in the form of a curve, were quite sufficient, however, to show that the true molecular formula of gaseous sulphur, undissociated, is S_8, a value it is interesting to note, which is in agreement with the conclusions previously arrived at by the application of the freezing-point and boiling-point methods to sulphur solutions.

Electrolytic Copper—A note upon recent improvements in the production of electrolytic copper appears in *Engineering.* It is a comparatively simple matter to get a good deposit of copper electrolytically, provided always that a sufficiently low current density is used. This, of course, involves a very large and expensive plant if any reasonable output of the metal is dedesired. With greater current densities difficulties make their appearance, and the deposit, in place of being smooth and homogeneous, becomes granular and lacks cohesion. By certain devices, of one nature or another, the troubles referred to above have been largely overcome. The effect of these is shown by the fact that 10 years ago an electrolytic bath for the depositing of copper commonly contained 75 to 100 times as much metal in solution as was deposited in 24 hours. Nowadays these figures have been reduced to one-fifth of the values stated. As a consequence, the proportion of the metal obtained in the wet way has been enormously increased, the world's production being now estimated at 500 tons of electrolytic copper per diem. One of the earlier plans of increasing the output was that introduced by Elmore, in which an agate burnisher was caused to continuously pass over the surface on which the deposit was being made. The resultant metal proved to be of extraordinary strength. In a more recent development a sheepskin, impregnated with animal fat, is used as a burnisher. Quite recently Mr. Seward Cowper-Coles has hit upon another plan, in which the copper is deposited upon a vertical mandril, which is caused to rotate at a very rapid rate. The centrifugal force developed and the wash of the electrolyte over the rotatory surface keeps the latter clean and free from gas, and as a consequence a smooth and dense deposit has been obtained with current densities approaching 200 amperes per square foot.

Radium Rays—The properties of certain radio-active bodies form the subject of a short note by M. Henri Becquerel, in *Comptes rendus.* The nitrate of polonium, of which samples were provided by M. and Mme. Curie, were found to be nearly as active as radium, both in its power of rendering air a conductor, and in its action on a photographic plate; but the radiation from this compound did not experience any modifications in a magnetic field, such as occurred with radium. When the polonium preparation was placed in a magnetic field of from 4,000 to 10,000 centimetre-gramme-second units, the impressions obtained on a photographic plate were just the same as when the field was absent. On the other hand, the rays emitted by the radium when placed in the field exhibited strong deviations, producing on a vertical plate impressions bounded by spiral curves. The examination of these curves enables an estimate to be made of the velocity of propagation of radium rays. This velocity is comparable with the angular velocity due to a field of 4,000 centimetre-gramme second units, and under plausible hypotheses give a velocity of propagation for the radium rays of the same order as those which have been found for the cathode rays.

Chicago Electrical Association.

The next meeting of the Chicago Electrical Association will be held at Room 1741, Monadnock Building, Chicago, at 8 P. M., on March 16. Mr. F. N. Boyer will read an address on "Arc Lighting."

Without.

[*From the Chicago Record.*]

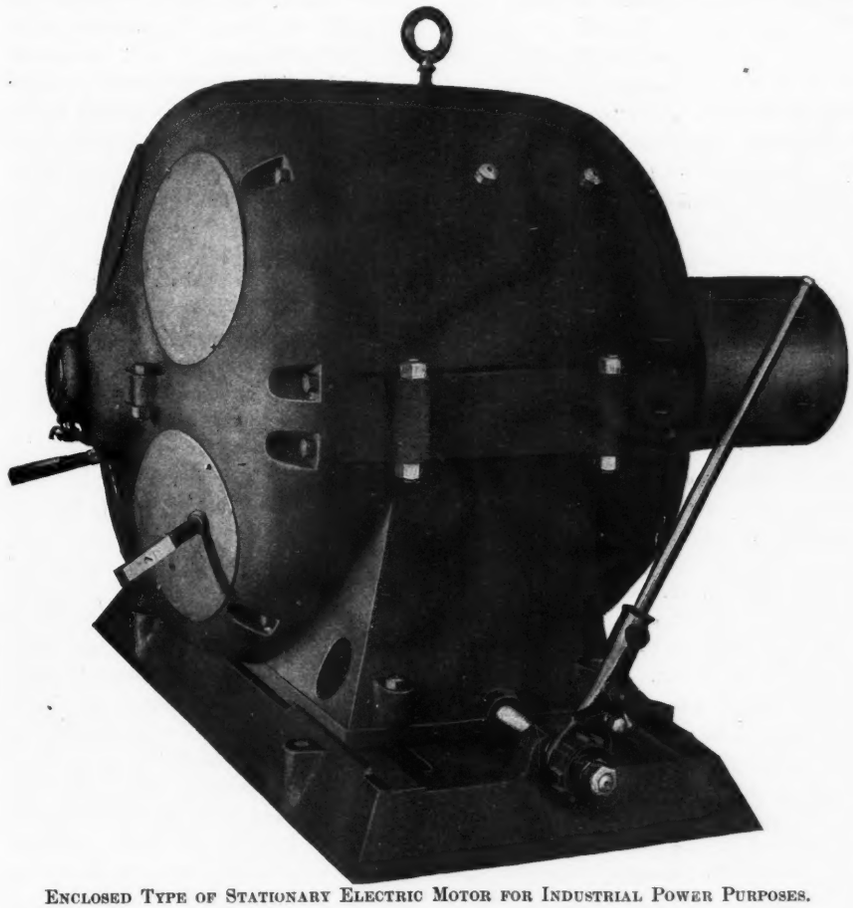
Liveried Menial: Me lud, the carriage waits without.

Lord Fitz Josher: Without what?

"Without horses, me lud, 'tis an automobile."

Stationary Power Motors for Industrial Purposes.

The varied and severe requirements met with in the many lines of industry where electric motors are coming to play so important a part, have created a demand for a motor of great adaptability. The Thresher Electric Company is manufacturing a type of motor embodying in its construction the points of excellence which render it especially suited to the transmission of electric energy. It is known as the "Type E" motor, and is built in sizes from one-quarter to 100 horse-power, either of the ventilated type or entirely enclosed, as is shown in the accompanying illustration, where it is necessary to protect the working parts from moisture or dirt.



Enclosed Type of Stationary Electric Motor for Industrial Power Purposes.

The field ring is cast of mild steel in one piece, except in the larger sizes, in which case it is divided through the centre to facilitate handling. The pole-pieces are bolted in place upon this ring, the two surfaces being carefully scraped, so as to reduce to a minimum the reluctance in the magnetic circuit.

The field coils are wound separately upon insulated spools, which are held in place by the polar projections.

The end flanges, which carry the bearings, are cast in one piece in the smaller machines, but in the larger are divided through the centre to facilitate examination and removal of the armature when necessary, the upper half acting as the bearing cap. The bolt holes being bored to a template, the ends can be swung so that the motor can be fastened upon the floor, wall or ceiling, and yet keep the bearings in an upright position. These ends afford entire protection to all working parts of the machine, which renders this motor especially adapted for general service; but, as stated above, the openings can be closed with removable coverings, as is necessary where the motor is expected to operate in a very moist or dusty place.

The bearings in all sizes are of the universally-supported self-oiling type, the journal being of one solid piece of gun metal, universally supported in the end piece and provided with a double-ring oil-feed from a large reservoir below, insuring cool running.

The armature is of the drum type, built up of laminations of soft annealed iron, carried on a spider, which is securely keyed to the shaft. Air ducts of ample size are provided to ventilate the armature, both horizontally and laterally.

In the smaller size machines the armatures are coil wound, the coils being first formed and taped and then placed in position in the slotted surface of the armature core, the ends being supported upon the extended heads of the core, so that the entire winding is on the periphery of the armature, giving the greatest amount of radiating surface with the least length of coil.

In the larger machines the armature is wound with a copper bar, which is made in one piece, so as to remove all soldered joints in the armature coil.

The commutator is built up on a special bushing, which is bolted in position upon the armature spider. The bars are of drawn copper, insulated with the best of mica, and are securely held in position by the end flanges of the bushing, which are so designed as to render it impossible for the bars to become loose. Ample wearing surface is provided so as to give a long life to the commutator. The upright connections are riveted in place and then sweated in, the leads from the armature being carefully soldered into a slot provided at the upper end.

The brush-holders are of the radial type, so designed as to take up the wear upon the brushes, which is accomplished by a lever actuated by an adjustable spring, to give an even and constant pressure upon the brush. Each brush is provided with a metallic contact with the commutator, so that no current is allowed to pass through the springs. A cross-section of one square inch for every 28 amperes of current is allowed, so as to reduce the resistance and consequent heating of the carbon brush.

The base is so designed as to allow of ample adjustment for taking up the slack in the belt, the motor being securely held in place by bolts, the lateral motion being accomplished by a screw of ample size, which is provided with a ratchet movement.

Motors of this type have been supplied from the Thresher Company's works, at Dayton, Ohio, to a large gold mining plant at Basin, Montana, where they are in satisfactory use in damp, underground workings.

A press telegram from Amsterdam, N. Y., says that, in consequence of the heavy rains the Schoharie Creek is bank high and the dam of the Empire State Power Company, at Schoharie Falls, where an electric light plant is being built, has been damaged to the extent of $2,000. Power engines and derricks have been carried down the stream.

Mr. Elmer P. Morris, the well-known electrical supply man, and Mr. George F. Porter, manager of sales for Kerite wires and cables, are visiting Havana.

Increasing the Efficiency of Steam Engines.

The recent centennial anniversary of the Royal Technical High School, at Charlottenberg, was made the occasion of several important announcements concerning the work of that renowned institution, which embodies in a remarkable degree the advanced technical science which has done so much to push Germany forward into the front rank of manufacturing nations, writes United States Consul-General F. H. Mason, from Berlin. Among these, the first rank is by common consent accorded to the paper of Professor E. Josse, head of the mechanical laboratory, in which are described with elaborate detail the results of his experiments with an original and highly interesting process for increasing the efficiency of steam engines by utilizing the heat of the exhust steam for evaporating another liquid having a lower boiling point than water.

It is well known that the steam boiler and engine, notwithstanding all improvements which it has undergone during the past hundred years, and its incalculable services to mankind, is nevertheless a wasteful and extravagant device for converting the energy stored in fuel into mechanical power. The ordinary, simple high pressure engine, which, after passing steam through one cylinder, discharges it into the air, utilizes hardly more than five per cent of the value of the fuel consumed under its boiler. The compound engine, in which the steam, after passing successfully through two, three, or more cylinders, is condensed, and the warm water of condensation restored to the boiler, utilizes under favorable conditions 12 to 13 per cent of the fuel energy, and there the economy appears to have stopped. An eminent American engineer has recently published an article reviewing the development of the steam engine, and closes his essay with the expressed opinion that with the compound machines and improved cut-off of recent years the practical limit of efficiency of the steam engine has been reached. The invention described by Professor Josse introduces a novel element into the problem and opens a new chapter in the record of steam-engine development.

The process is the joint discovery of Mr. G. Behrend, a Hamburg engineer, and Dr. Zimmermann, of Ludwigshafen; and although first patented in 1889, it has only recently been matured and its application perfected by the employment of an auxiliary engine, which, utilizing the heat contained in the exhaust steam, gains as high as 56 per cent additional motive power without increasing the expenditure of fuel. The principle and process involved are simple, and may be briefly described, as follows:

It is plain that, with all progress which has hitherto been made in steam-engine practice through higher pressures, superheated steam, economical cut-offs, or successive cylinders, there is always an important and inevitable loss of heat energy when the steam, having done its work, is discharged into the open air or changed back to water by contact with cold water in a condenser. When the exhaust is into the open air, the steam has a temperature of about 100 degrees Celsius (212 degrees Fahrenheit); when it passes into a condenser, the steam has a temperature of 60 degrees to 70 degrees Celsius (140 degrees to 160 degrees Fahrenheit), according to the vacuum. The corresponding latent heat of steam, given up upon change of form from steam to hot water, has hitherto run to waste in the condensing or cooling water, or in the air. Messrs. Behrend and Zimmermann attacked the problem of utilizing this wasted caloric by employing it to create a new supply of steam by evaporating some liquid which has a lower boiling point than water, and for this purpose they chose, after many experiments, sulphurous acid (H_2SO_3), which is not only cheap and easily obtained, but has the further advantage of a viscous consistency and lubricates the inner working surfaces of the machinery without corroding them. Their demonstrations, although not practically conclusive, were so promising that Professor Josse, as a technical authority on this subject, took up the problem, and, after several months of highly satisfactory laboratory experiment, caused to be constructed and connected with an ordinary working steam engine of the compound type an additional condenser and auxiliary engine, the power of which could be exactly measured. The whole working apparatus is shown in the engraving herewith submitted, and the technical details will be explained by the drawing, and may be thus described.

Referring to a diagram, in which dimensions were given in millimetres, H and N represent the high and low pressure cylinders of an ordinary compound steam engine, with a stroke of 500 millimetres (19.69 inches) and a speed of 41.5 revolutions per minute. From the low-pressure cylinder N the exhaust steam passes into the surface condenser, called in the diagram the "vaporizer." In this vaporizer, or condenser, the cooling medium used, instead of water, is liquid sulphurous acid (H_2SO_3), which has a boiling point so low that it is immediately decomposed by the heat of the exhaust steam, whereby the sulphur dioxide gas (SO_2) is liberated, which passes over into the cylinder of the auxiliary engine S, where its work is done as in an ordinary steam engine. The auxiliary cylinder has a diameter of 300 millimetres (11.81 inches) and a stroke of 500 millimetres, with a speed of 77 revolutions per minute.

After passing through this cylinder, the sulphurous vapor enters the surface condenser, around the tubes of which cold water flows as in an ordinary steam plant. Here the sulphurous vapor is condensed to liquid and is forced by the pump P back into the vaporizer, where it begins its cycle again, the same SO_2 being used over and over again indefinitely. There are therefore, in fact, two condensers, the first serving, as it were, as a boiler or steam generator for the auxiliary engine; and this boiler, instead of being fired by coal, obtains all its heat from the exhaust of an ordinary steam engine, and, instead of converting water into steam, evaporates a liquid which is much more volatile—*i. e.*, has a far lower boiling point.

In the long series of recorded tests with the plant shown in the engraving herewith transmitted, the following results were attained:

The steam engine is of the compound type, of good, modern construction, and, being given a steady load, developed 34 indicated horse-power, with a consumption of 8.6 kilogrammes (18.96 pounds) of steam per indicated horse-power hour. The auxiliary machine working with the sulphurous vapor indicated 19 horse-power—that is, an increase of 56 per cent and yielding, instead of 1 horse-power, 1.56 horse-power for the same steam consumption and reducing the steam consumption from 8.6 kilogrammes to 5.5 kilogrammes (from 18.96 to 12.13 pounds) per indicated horse-power.

The experiments showed on the average that for every 15 kilogrammes (33.169 pounds) of steam passing through the main engine, 1 horse-power could be gained in the auxiliary machine. Applied, therefore, to an ordinary single-cylinder steam engine, exhausting into the air at high temperature, the percentage of power saved by this new device would be very much higher than the economy reached in these experiments, which, as has been shown, were made with a highly-improved compound engine. From the average of these experiments, it may be broadly stated that, given a fairly economical compound engine, using 7.5 kilogrammes (16.5 pounds) of steam per

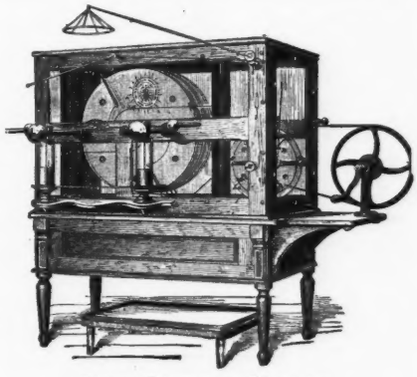
indicated horse-power hour, half an indicated horse-power could be produced in the auxiliary machine for every indicated horse-power developed in the main engine. Assuming an average vacuum of 60 centimetres (23.62 inches), corresponding to a temperature of 60 degrees Celsius (140 degrees Fahrenheit), the saving of heat must be accomplished by using a liquid which can be vaporized to a high pressure at or below that temperature. Assuming, further, the upper and lower limits of temperature within which the operation is confined to be 60 degrees and 20 degrees Celsius (140 degrees and 67 degrees Fahrenheit), the pressure of the sulphurous vapor would range from 10.05 down to 2.35 atmospheres above open-air pressure. A working pressure as high as ordinary steam-boiler pressure is therefore readily obtained at a comparatively moderate temperature. Moreover, the volume of sulphurous-acid vapor necessary to contain the number of heat units corresponding to the work to be performed is much smaller than the volume of steam which would be required for the same purpose. As the saving to be effected by the auxiliary engine depends directly upon the difference between the highest and lowest temperatures involved, the greatest gain will therefore be made either when the water in the surface condenser is as cold as possible or when the heat of the exhaust steam from the engine is at a maximum, as is the case with a single-cylinder steam engine without condenser, which may be anywhere up to 212 degrees Fahrenheit.

The expense of this improvement is practically all in the construction cost of the vaporizer, condenser, and auxiliary engine itself, and its economy may be realized from the fact that the exhaust steam from a 2,000 horse-power central-station engine should furnish power to drive an additional 1,000-horse-power engine, which can be connected as an extra cylinder to the steam engine or run independently, and thus increase by 50 per cent the power developed without adding a pound to the quantity of fuel consumed. When, in view of the present coal famine throughout Europe, it is remembered that the steam engine energy of Germany alone, afloat and ashore, is not less than 3,717,264 horse-power, the commercial importance of such an improvement will be readily apparent.

These directors of the Delaware and Atlantic Telegraph and Telephone Company, of New York, were elected on February 13: Thos T. Eckert, Jas. Merrihew, ruary 13: Thos. T. Eckert, Jas. Merrihew, Huidekoper, J. E. Mitchell, J. M. Brown, John E. Hudson and G. W. E. Atkins.

Static Induction Machines for Therapeutic and X-Ray Uses.

The first electrical machine for producing static electricity was made by Otto von Guericke, of Magdeburg, in Germany, early in the seventeenth century. This machine consisted of a globe of sulphur, upon which the hands of the operator were pressed while it was turned round by means of a crank. Not many years later the old "bottle" form of frictional machine was invented and was used by such early experimenters as Cavendish, in England. A little later came the glass wheel frictional machines, one of which was possessed by Benjamin Franklin. It was not until 1865 that the induction static machine was devised by Professor Holtz, of Berlin, whose name has become a household word in electrical



STATIC INDUCTION MACHINE.

circles on account of this remarkable and brilliant invention.

This machine worked upon the now well-known induction principle and was by all odds the most powerful generator of static electricity that had been invented up to that time. It suffered, however, from uncertainty of operation and unreliability on account of the large influence upon it of damp weather. Great improvements were introduced by Wimshurst, in England, and Toepler, in Germany, both making the machines more reliable, as well as more powerful.

The illustration which is shown herewith represents a machine of the Wimshurst-Holtz type, enclosed in an air-tight glass case in which is situated also a small Toepler-Holtz machine for charging the plates of the larger machine. This compact and reliable form of apparatus is built by the Waite & Bartlett Manufacturing Company, of New York, who also manufacture a large quantity of accessory electrical and medical apparatus. It has been found that for working the X-ray tubes the induction static machine possesses many great advantages, among them being silence and the absence of all fumes and noxious odors arising from the batteries employed with the usual coil outfit.

VIEWS, NEWS AND INTERVIEWS

The presidency of the Massachusetts Institute of Technology, at Boston, was offered recently to Rear-Admiral William T. Sampson, U. S. N., who is now stationed at the Charlestown Navy Yard as commandant. Admiral Sampson declined the offer.

Recent statistics show that there were last year published in the United States 176 books in the sciences as compared with 143 in 1898. These numbers do not, however, include educational or medical books, or books in the "useful arts."

Lord Rayleigh, Professor Ramsey, Dr. W. Hittorf and M. Moissan have been elected honorary members of the German Chemical Society.

A gentleman in one of the eastern cities had the misfortune to be afflicted with increasing deafness, until he was practically unable to hear anything. He sent for the local bell-hanger and ordered an electric bell put on his desk and connected with the door of his office so that when any one entered the bell would ring. A three-inch bell was put in, but failed of its purpose because it did not make enough noise. It was taken out and an eight-inch electromechanical gong installed in its place. This would make a visitor in the office jump out of his chair when it rang, but the deaf man was serenely unconscious of it. The bell-man was in despair, until a brilliant idea took possession of him. He removed the gong and substituted for it a very small fan-motor which was directed at the desk. Now when a visitor enters the door a gentle blast of cooling air announces his presence to the man who can not hear a fire-alarm gong.

The other day some electrical men and others were gathered in a little village on the New England coast to lay a cable. There was a roaring gale blowing, with squalls of snow, and the weather-wise salts of the neighborhood looked uneasily at the glass, which stood at 28.65 inches.

"This kind of thing would make a holiday in an incandescent lamp factory," said one of the electrical men.

"Why?" asked one of the others.

"Because the vacuum pumps won't work well when the barometer is low," was the answer. "The Sprengel pump is really a barometer itself, and in weather like this it will not make a good vacuum. Lamps exhausted on such a day are generally bad."

OPPORTUNITIES FOR EXPORT BUSINESS

Among the new companies just formed in Paris, France, which, according to advices, will need considerable machinery and supplies for their respective undertakings, are La Compagnie Electrique de St. Pierre de la Martinique, which has opened offices at 17 Boulevard Madeline, and has a capital of $50,000. It is to engage in electrical engineering.

Upon the return to Newcastle, England, of Mr. A. E. Le Rossignol, resident engineer of that city, who has been in this country for a few months studying street railway conditions in the principal cities here, it is expected that the Newcastle corporation will ask for bids on a power house of sufficient capacity to generate electricity for a double-track electric railroad, 15 miles in length and also for 150 trolley cars. Mr. Le Rossignol has already sailed.

Consul-General Stowe, at Cape Town, serves notice on American manufacturers through a report to the Bureau of Foreign Commerce in the State Department, that as soon as the war in South Africa is over there will be a boom which will afford many opportunities for the introduction of American goods and American enterprises. The country will then be short of supplies. The country will want the countless things required by a nation emerging from a war.

"La Societe des Mines de Camaguam" is the title of a company which has just been formed in Brussels, Belgium, with a capital of $300,000, to work some large deposits of copper ore in the Cacafava district of Rio Grande do Sul, Brazil. On account of early delivery being an important factor to the quick developing of the undertaking, it is stated that considerable machinery will be bought early in April by this company in the United States.

In about six weeks from now Mr. Thomas Rodd, chief engineer of the Pennsylvania Steel Company, and consulting engineer of the Westinghouse interests, is expected to return from Manchester, England. Prior to that time various bids will be asked of Pittsburgh manufacturers for machinery, equipment, etc., needed for the new plant of the British Westinghouse Company, which is to be erected at Manchester. Mr. Rodd's visit to England is entirely in connection with the new Westinghouse works.

The entire local tramway lines at Durban, Natal, are to be converted to the overhead trolley system, at an estimated expenditure of nearly $1,250,000. The total length is about 17 miles of single track. The borough engineer estimates the expenditure as follows: For track and overhead equipment, $443,880; 22 motor cars, $70,000; power station including power and boiler-house, car shed, repairing shop, coal siding, etc., $50,000. Specifications, form of bids and all other particulars can be had by addressing Webster, Steel & Company, No. 5 East India avenue, Leadenhall street, London, E. C., who are agents to the Durban Corporation.

Messrs. William Reid & Company, engineers and importers of industrial and agricultural machinery, of Rua Visconde de Inhauma 48, Rio de Janeiro, Brazil, have entered into a contract with the Brazilian Government for the exclusive right, during a term of 15 years, for the sale of electric energy, produced by water-power, and for its application for all industrial uses in the city, except illumination. This firm will shortly take steps toward the construction of a power station, which is to be built on the main fall of the river Lage, at a distance of about 37 miles from the city, where it is said 1,800 horse-power can be obtained. There are opportunities for engineering firms to introduce their machinery not only with the above-named firm but also in many other undertakings now contemplated in Brazil.

No large orders in any line of manufactured product have lately been placed through local export firms for the Japanese market. Yet there are said to be extensive contracts pending which involve the placing of extensive orders not only for railroad material, but also for electrical undertakings and extensive power plants. One engineering firm in New York city has for three mails past looked for an order for four engines and quantities of other machinery. Japan, as it is well known, has yet to import 90 per cent of her engineering material. This business must be divided between the United States, England, Germany, Holland and Belgium. But as it has recently been recognized by our competitors the United States has the advantage on Japanese trade, not only on account of price but proximity. Consequently it is only a question of time when the business will arrive.

The Western Electric Company, as previously stated in the ELECTRICAL REVIEW, has started 72 of its operatives for its plant, in Belgium, for the purpose of teaching native workmen the uses of American machinery, and the manner of constructing telephone and other electrical devices after American methods. The demand for small electrical apparatus, such as fans, small motors, push buttons and telephone supplies, is gradually increasing for export. Notwithstanding the extraordinary demand for such articles from Central and South America, it is claimed by a local export firm that it is difficult to find a manufacturing firm who has a complete catalogue of such supplies in the Spanish language. At this time of the year, when importers abroad begin to put in a stock of these goods, the aid of such a book to order from can not be overestimated, not only to parties abroad, but to local export merchants.

Further details concerning the plant for manufacturing purposes which is to be built near London, England, under the supervision of Charles J. Goldmark, of No. 29 Broadway, New York, are said to include the following machinery, all of which is to be purchased in this market as soon as the designs and specifications are ready: A 100-horse-power steam plant, including a system of high and low pressure steam distribution for industrial purposes and heating; a combination ammonia and brine refrigerating plant of about 600 horse-power in dynamos and motors for lighting and power purposes; a system of hot and cold water distribution. The plant will cover some four acres of ground, and six steel-cage buildings will probably be required. There will in all probability be installed a filter plant and electric pumps. The construction will probably begin early next Summer, and it is expected that the cost of the undertaking will reach close to $700,000.

In expectation of further orders from Japan for finished iron goods and electrical material, the manufacturers who have recently received contracts from Yokohama, Tokio, Kobe and other commercial centres in Japan will not talk about them. Competition is too keen, and greater fears exist of home firms than of foreign competitors. A New York daily quotes a manufacturer as saying: "Wait until the shipments are made and other orders are finally placed, then one can speak without fear of letting his rivals know of the business yet to come." During the second week in February some extensive shipments of iron and steel material left New York for Japan. The heaviest lot of rails shipped in many months was forwarded during the above

period, its value reaching $75,141. Bridge material came next in importance, $53,000 worth being sent. Shipments of iron pipe reached nearly $30,000, while those of electrical material were $11,000.

The Havana Electric Railway Company, of which Mr. William Hanson, of Montreal, is president, having amalgamated its interests with those of the Havana Traction Company, will now proceed with its work of reconstruction, and some 30 miles of track will be laid. The other concerns interested are the Banque Internationale, of Paris, Buffer & Todd, of London, and what is known as the Harvey Syndicate, of New York. The railway will be running by the first of September, as the rails are now being landed and the machinery will be shipped without delay. The Cuban Electric Company is another corporation almost wholly controlled by Canadians. This company has secured the ferry system between Havana and Regla, on the opposite side of the harbor. From Regla the Cuban Electric Company has secured the right of way to Guanabacoa, three miles distant, and a first-class electric railway will be in operation between the first two points within a few weeks.

Inquiries from Italy for electrical apparatus keep increasing. The last mail brought from Milan one of these inquiries to an engineering firm in New York for what they claim will make up a medium-size power plant, valued at at least $38,000. The plant includes several large pieces of machinery. Another concern is bidding also at request from some Italian city for two large water-wheels and a quantity of iron pipe. In the less important inquiries hardware and electrical supplies figure principally, and show that quite a trade is available in that country. Considerable interest exists among merchants in the Italian trades concerning the ratification by the Italian Chamber of Deputies of the recently signed reciprocity arrangement under the third section of the Dingley Act, which took place in Washington not long ago by the representatives of the two countries. Merchants who are familiar with Italian trade say that the reciprocity arrangement will mean an increase of both exports and imports. As has been many times stated, there is an available Italian market for American machinery. The steamship connections between the two countries were never better. There are five lines plying between New York and Italian ports. While business has shown an increase in recent years it is by no means what it should be. The demands most urgent in Italy, for which the United States could compete at present, are coal, machinery, and many forms of manufactured iron and steel products. In the electrical engineering lines evidences are at hand by nearly every mail.

The electrical undertakings in Great Britain are so numerous that during this year the leading electrical engineering concerns of this country are looking forward to even a greater volume of business from that country than ever before. It is true that the bulk of this trade is secured through the British agents which the American firms usually have stationed at London. There are, however, many American manufacturers who have no agent in the capital of England. For the benefit of these attention is here drawn to the newly-awakened spirit of enterprise on the part of British municipalities in the hope that manufacturers and contractors in this country may secure a share of the work of supplying the plants. The recommendation is made that American firms who manufacture and deal in street railway and other electrical appliances put themselves in communication with the municipal authorities in Great Britain. This can be done by addressing the city engineer. Nearly every city or town of importance in Great Britain has such work under progress or in contemplation, and their mail can hardly go astray to the city engineer of any large city in England or Scotland. The same suggestion holds good to a limited extent for Irish or Welsh municipalities. Fortunately for manufacturers in this country, the taxpayers in Great Britain, at least the majority, do not object to their municipalities awarding contracts to foreign competitors. It is the manufacturers who object to the foreign competition on municipal work. Many industries, particularly those of engineering, iron, steel, etc., in Great Britain are very busy now, and those manufacturers are at a disadvantage when the question of delivery is stipulated. All these circumstances are of advantage to the American concern who may care to develop the trade.

In addition to the many encouraging reports arriving from Mexico concerning the expansion of trade in American products, there is hardly a week in which quotations are not furnished to engineers, contractors and railroad builders in that country for large quantities of material needed for undertakings about to be started. All these quotations mean that a steady trade may be looked for throughout the year, for, as it has frequently been stated, prices and deliveries are, according to merchants, much more satisfactory from this country this season than from either Germany or England, our greatest competitors in the Mexican market; England, particularly on account of the vast sums invested there by her subjects in many undertakings. In Mexico's trade those competitors are also at a disadvantage on account of our proximity. Several schemes are now under consideration for the erection of new electrical works, says the New York *Commercial*. Two capitalists in the City of Mexico have applied to the state government for a concession to establish two electric light plants there. The Topo Chico Street Railway, in the city of Monterey, is being extended to the Mexican International Railroad depot. The street railroads at Morelia are to be extended several miles. The San Louis de Potosi Street Railroad is soon to be converted into an electrically equipped line. These and many other electrical undertakings are to be supplied with material from this country. There is hardly a steam railroad in Mexico which has not a purchasing agent in New York city, and thus, together with the direct trading which manufacturers are more and more entering into every year, the commercial relations of the two countries are becoming closer. The foreign residents in Mexico are rapidly increasing as facilities for communication become greater and security of life and property grows stronger. The Spanish colony, without a doubt, is the wealthiest and most numerous, especially in the national capital and other large cities. The Spaniards are engaged in all branches of commerce in Mexico. Next to the Spaniards are the citizens of the United States, as far as numbers are concerned. British subjects are well represented in Mexico, as far as the investment of capital is concerned; many of the public works are due to the funds provided for their execution by them. The German colony is growing every year, and they are strengthening their hold on trade and commerce. The French colony is by no means insignificant in Mexico, but is chiefly engaged in the retail business of the large cities. Those who are thoroughly familiar with Mexican trade say that notwithstanding all this foreign element American trade is bound to advance as long as satisfaction is given. A manufacturing concern can transact business in Vera Cruz or Mexico City with the same safety as they can in St. Louis, and every year this fact becomes better known to a greater extent in the southwest, where the bulk of Mexican business is to-day transacted.

AMERICAN EXPORTS

The John A. Roebling's Sons Company have just made a shipment to Manila of 2,200 miles of galvanized wire, 14 gauge, and weighing nearly half a million pounds.

The Phœnix Glass Company, of New York, recently shipped a large consignment of its shades and electric light glassware to Costa Rica, C. A., the goods having been selected and forwarded by the proprietor of the electric lighting plant in that city, Mr. J. Mendiola Boza, who was visiting New York some weeks ago.

The Bullock Electric Manufacturing Company, of Cincinnati, Ohio, has lately been exceedingly active in exporting motors. In addition to the 41 printing press motor plants which are described and illustrated in another column of this issue of the ELECTRICAL REVIEW, it has sent abroad a large number of motors and generators of the standard patterns. These machines are mostly of a multipolar ring-frame, drum-armature type, distinguished by large and solid bearings and great breadth of commutator. The company is at present constructing two 800-kilowatt generators for a plant at Alexandria, Egypt, and a large number of machines for other export orders are also in process of construction in the shops of the company, at Cincinnati.

The Morris Electric Company have been devoting a large amount of time and energy to their export business during the past few months. Every Ward Line steamer leaving New York carries a large shipment of machinery, tools and material consigned to Havana by this company. The Earn Line, from Philadelphia, also includes goods of theirs with each of its cargoes. The Morris Electric Company has shipped quantities of material and machinery during the past month to Australia, Portugal, England, South Africa, Argentine, Brazil and Mexico, and they have in course of preparation large shipments for Cuba, Portugal, Africa, London and Mexico. The treasurer of the company, Mr. Elmer P. Morris, has been in Havana for the past two weeks and is expected home very soon.

The Holophane Glass Company, of New York, manufacturers of shades for electric and other lights, is largely interested in exporting and has recently sent away a considerable consignment of its goods. Some 600 holophane spheres have been sent to light the facade of the Electrical Building at the Paris Exposition. The Toerring Lamp Company, which will light the main thoroughfares of the exposition with arc lamps, has also been supplied with these prismatic glass shades. Just before the recent sailing of the United States cruiser Chicago, she was fitted up throughout with these fittings and globes, and the manufacturers state that many complimentary letters have been received from different members of the Navy Department and officers, concerning the success of the installation.

The Sprague Electric Company is at the present time doing a very large and increasing foreign business, particularly in its Lundell motor and generator products and Sprague electric elevators. The motor and generator business in Great Britain is handled by J. H. Holmes & Company, who are said to do the largest small motor and generator business in that territory. The Sprague Company is at present installing 50 electric elevators for the Central London Underground Railway. These electric elevators are the largest ever built. The South American business is increasing very rapidly. Their agents in Argentine have lately closed a large number of elevator contracts. Lundell fan motors are popular with the export trade and are shipped in great quantities to warm climates.

The Stillwell-Bierce and Smith-Vaile Company, of Dayton, Ohio, manufacturers of the well-known type of Victor turbine wheels, are installing a large number of water-power plants in many quarters of the globe. A description appears elsewhere in this issue of the fine plant of the Isle of Man Electric Tramways Company, which operates railways between Douglas, Laxey and Ramsey, on the Isle of Man. At North Sydney, Nova Scotia, an installation which will develop 1,650 horsepower under 185 feet head of water, is being installed for R. G. Reid, and the Ottawa Electric Railway Company, of Ottawa, has also just been supplied with an installation developing 1,800 horse-power. In Rossland, B. C., the West Kootenay Power and Light Company has just installed 2,400 horse-power of these wheels, which are now running. A plant was shipped recently to Australia, and another of small dimensions to Jamaica. There are now under construction a number of special wheels to operate under 53 feet head and direct-coupled to dynamos furnished with the Giessler electromechanical governor. This outfit will go to Japan. There is also under construction by the company a plant of something over 2,000 horse-power for the Sao Paulo Light and Power Company, of Sao Paulo, Brazil, of which a short account was given on page 206 in the issue of the ELECTRICAL REVIEW for February 28. Another plant has gone to Brazil also within the last few weeks.

PERSONAL.

Mr. A. F. Stanley, of Stanley & Patterson, New York city, is suffering from an attack of the grip.

Mr. M. S. Conner, of the Western Electric Company, sailed for London on March 7. He will be connected with that company in London.

Mr. H. Durant Cheever, one of the managers of the Okonite Company, Limited, and Miss Zora Horlocker were recently married. The friends of both are extending their cordial congratulations, in which the ELECTRICAL REVIEW heartily joins.

Late News.

March 24 has been selected as the day to begin the opening of the big railway tunnel in New York city. The ceremonies will be held in City Hall Park, in front of the ELECTRICAL REVIEW office.

President H. H. Vreeland, of the Metropolitan Street Railway Company, New York, announced on Tuesday of this week that the cable routes of his system would be converted to underground trolley system this year. This will mean an expenditure of almost $10,000,000, including new station facilities.

The Special Grand Jury which has been considering the conspiracy to lower the market price of the Brooklyn Rapid Transit Company's stock returned indictments on March 6 against six men. Some of them are charged with feloniously circulating false and misleading reports to affect trade and commerce, others with committing a misdemeanor.

Brooklyn Rapid Transit Company.

The Brooklyn Rapid Transit Company, of Brooklyn, N. Y., announces several changes in its official personnel in the following circular:

"In order to relieve President Rossiter of some of his duties, and to change the organization of the company to fit the requirements of its enlarged system, the Brooklyn Rapid Transit Company at a meeting of its Board of Directors created the position of acting general manager and J. C. Breckinridge, heretofore chief engineer of the company, was appointed to that position.

"The board also created two additional vice-presidents, one having charge of matters relating to taxes, insurance, real estate, franchises, legal rights, litigation, other than negligence, and land damage, legislation, etc., and the other having exclusive charge of negligence and land damage claims. To the first of these positions T. S. Williams, formerly secretary and treasurer, was elected. The other vice-presidency has not yet been filled, but pending the selection Mr. Williams will assume the duties.

"C. D. Meneely, heretofore assistant secretary and treasurer, was elected secretary and treasurer, vice T. S. Williams, resigned."

American Printing Press Motors Abroad.

For the operation of printing presses no more satisfactory power than that furnished by an electric motor has ever been discovered. The ability to maintain a steady speed through great variations of load is very necessary in this work, as the difference between simply moving the parts of the press and deeply pressing the type into the paper at the moment of the impression is very large. Perhaps the greatest difficulty that has attended the use of electric motors for this purpose, however, has been regulation of the speed and the operation of the press at very slow speed in starting and in "making ready." In the motor equipments of this character manufactured by the Bullock Electric Manufacturing Company, of Cincinnati, of which no less than 41 have been applied to newspaper offices in Great Britain and on the Continent of Europe, a novel method of governing the regulation is used, called by the manufacturers the "teaser method."

The driving motor is directly-coupled to the printing press and its speed is under such control that the operator, by a single hand-wheel, can start the press, slowly moving it along inch by inch for "making ready," or with ease bring it up to slow motion or to any one of the speeds required in its operation.

The speed of the press is controlled by a machine greatly resembling a street car controller, only one hand-wheel being used for the operation of an installation. The motor which is attached to the press is iron-clad, of a multipolar type, and very slow speed. By the direct attachment of the motor to the press all belting and shafting is eliminated, and both cleanliness, flexibility and space are gained.

The illustration, Fig. 1, which is shown herewith, represents a complete outfit consisting of a Hoe sextuple press with color attachment, direct-coupled with a Bullock motor. Fig. 2 shows another view of the motor alone.

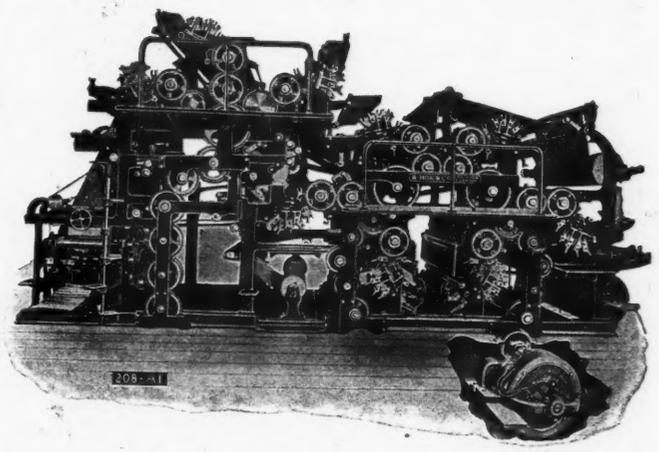


FIG. 1.—SEXTUPLE COLOR PRINTING PRESS WITH DIRECT-COUPLED MOTOR.

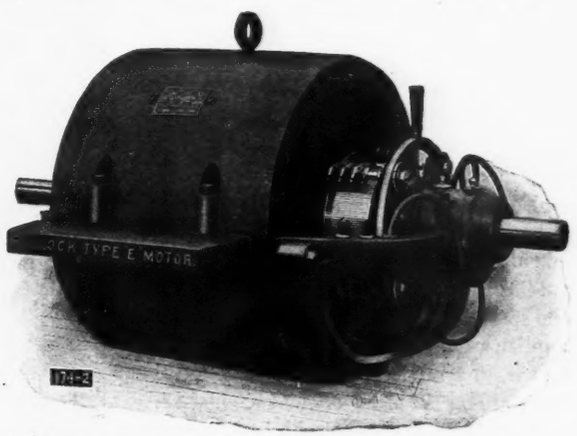


FIG. 2.—TYPE OF SEMI-ENCLOSED MOTOR FOR DIRECT ATTACHMENT TO PRINTING PRESS.

Aluminum Conductivity Experiments at the Massachusetts Institute of Technology.

In the course of electrical engineering, at the Massachusetts Institute of Technology, a Japanese student has chosen for his subject a study of the size of wire necessary when aluminum is used for a conductor of electricity. He is to study the relative capacity of aluminum as compared with that of copper. As the price of copper has risen so much, and as the price of aluminum has fallen, the use of the latter metal has already begun to compete with that of copper in electrical manufacture. Insurance people have appointed a committee to follow the results of such tests and to make tables from them, as it is most important to know, when buildings are wired, the safe limit of the amount of current which any wire, covered or uncovered, may be made to carry. If the results of this thesis are satisfactory, they may form the foundation of such a table.

The method chosen for determining the relative capacity of the aluminum is entirely original, and is a method in which the temperature of the wire will be measured directly while it is carrying different amounts of electricity; formerly this was studied by other qualities, and because the resistance of a sample wire changed, for instance, it was inferred that the temperature at that time had risen or fallen a corresponding amount.

Hopkinson & Talbot, engineers, No. 26 Victoria street, London, England, are asking for bids on 130 tramway car bodies and trucks and on a large quantity of electrical equipment.

LITERATURE

Electric Wiring. By Cecil P. Poole. Four by six and one-half inches. Limp leather. 100 pages. 46 illustrations. New York. The Power Publishing Company. Supplied by the ELECTRICAL REVIEW at $1.00.

A good, simple, plain practical book, by a practical man, for practical men.

The first important book on the Anglo-Boer War from the standpoint of an Englishman strongly opposed to the policy of the English Government will be published immediately by the Macmillan Company. It will be called "The War in South Africa; Its Causes and Effects," and is by J. A. Hobson, who was recently the correspondent in South Africa for the Manchester *Guardian*. Mr. Hobson's book is a sober, restrained account of the whole business by a trained observer.

The Central Pennsylvania Telephone and Supply Company, at its annual meeting in Williamsport, elected directors for the ensuing year as follows: R. M. Bailey, J. W. Boyer, J. V. Brown, Addison Candor, William Emery, John A. Gamble, C. LaRue Munson, John R. T. Ryan, Henry W. White and E. B. Westfall, of Williamsport; S. S. Blair, of Tyrone; C. E. Chittenden, of Scranton; C. Jay French, of Boston; Richard O'Brien, of Scranton; H. S. Huidekoper, of Philadelphia. The newly elected board organized by electing R. M. Bailey, president; Richard O'Brien, vice-president; John S. Furst, secretary and treasurer; J. E. Wilkinson, general manager.

The New England Telephone Company has sold about $400,000 30-year four per cent debenture bonds. The price is not given out, but is thought to be about par. Bids were privately solicited for $1,000,000 bonds, but only the above bid was accepted.

Alternating-Current Switchboards.

Alternating-current switchboards for polyphase circuits have been carried to a high degree of development by the Westinghouse Electric and Manufacturing Company. Alternating-current has been the special study of this company; years of care and attention have been devoted to designing apparatus for controlling and handling it, and in introducing the perfection of simplicity into the details of construction. Fig. 1 shows the front of an eight-paneled switchboard for two-phase circuts, erected in the power station of the Valley Electric Company, Fallston, Pa. Fig. 2 shows the rear of the same. This switchboard is an example of the standard practice of the makers for two-phase installations, for 1,100 to 2,200 volts. The three left-hand panels of Fig. 1 control three two-phase generators running in multiple, the next three panels control three two-phase four-wire feeders and the last two panels control four single-phase two-wire feeders. As additional generators and feeders are added to the plant the switchboard can be enlarged without interrupting the service. Should it be necessary to install extra or special apparatus, panels can be placed in the space below the standard panels. All appliances are mounted directly on the panels, so arranged that no charged metal parts are on the front of the switchboard, thus avoiding accidental shocks.

The generator panel to the left of Fig. 1 contains a pilot lamp, two alternating-current ammeters, two keyless sockets and lamps, a four-pole high-potential double-break plunger switch, three field plugs, two for the main, separately excited alternating-current field, and one for the composite field, a combination alternating-current and direct-current rheostat mounting, a ground detector receptacle and plug, a push-button, a synchronizer receptacle and plug, a six-point voltmeter receptacle and plug, three switchboard transformers and transformer fuse-holder.

The second and third generator panels are equipped very similarly to the first panel, except that there are omitted one keyless socket and lamp, a ground detector receptacle and plug and push-button. A four point, instead of six-point, voltmeter receptacle is used, and only one instead of three switchboard transformers and transformer fuse-holders.

The three two-phase feeder panels to the right of the generator panels contain a pilot lamp, two alternating-current ammeters, one four-pole high-potential single-break switch, and four single-pole fuse-holders. The two feeder panels to the extreme right of Fig. 1 each control two single-phase feeders connected one to each phase of the two-phase busbars; they each contain a pilot lamp, two alternating-current ammeters, two two-pole high-potential single-break plunger switches, and four single-pole fuse-holders. Two voltmeters, one connected with the busbars, and the other to either of the generators, are swung on a bracket to the left of the switchboard, in full view of the operator when handling the switches.

The board described above represents the construction usually employed for multiple running of generators, although its makers build various types of standard alternating-current switchboards.

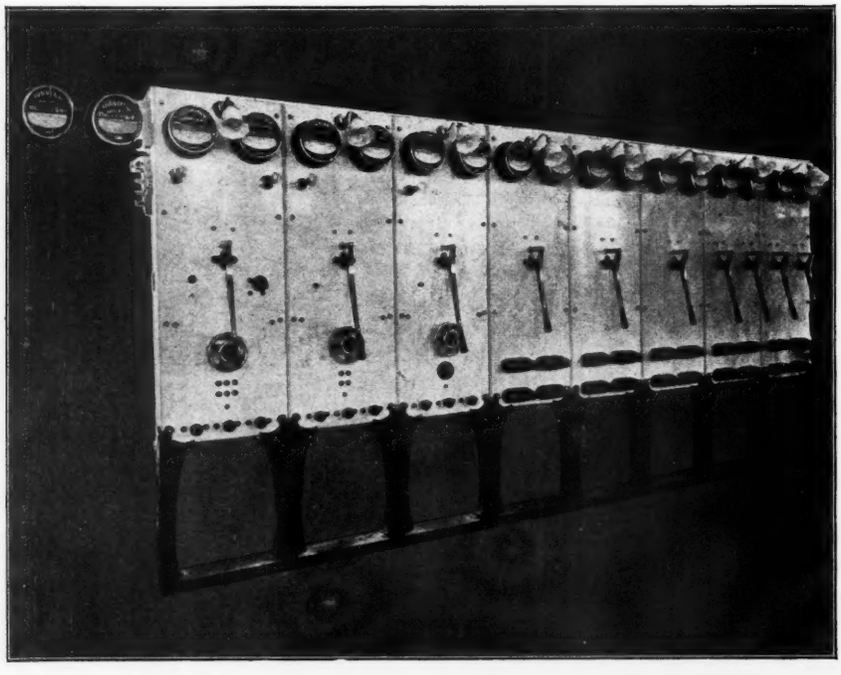


Fig. 1. - Front of an Eight-Panel Alternating-Current Switchboard.

For separate running of generators, special feeder panels are added to the switchboard, being so arranged that any feeder can be operated from any generator. The apparatus furnished enables the feeders to be transferred from one generator to another without any perceptible winking of the lights.

Any of the standard generator panels may be used for separate running, and, if desired, the main switch may be dispensed with and the generators taken out of service by operating the field circuit by means of the field plugs. High-potential plunger type switches are used, as they are practically non-combustible. No charged metal parts are exposed to the front of the board, and the construction permits thorough examination of the switch to be made easily from the back.

Fuses are mounted in lignumvitæ fuse-holders, enclosed in a chamber which is air-tight, except for one small vent. The melting of a fuse causes a rapid expansion of the air contained in this chamber, and consequently creates a strong and quick air-blast through the vent, blowing out the arc. Lignumvitæ being an extremely heavy, close-grained wood, is not readily burnt by the arc. It has great strength combined with considerable elasticity, thus the tremendous expansive tendency produced by the arc is properly restrained, while just enough flexibility to avoid rupture is allowed. This type of fuse was developed by the Westinghouse Electric and Manufacturing Company as early as the World's Fair installation, and has now become the universal type for this class of work. Fuse-holders are mounted at the bottom of the switchboard and the vent is so constructed that it discharges fuse vapors downward toward the floor. The holders are detachable from the board, and the fuses may be renewed most conveniently and without danger.

The alternating-current generator field rheostat is mounted on the back of the generator panel, and is so designed that the exciter rheostat can be placed within the alternating-current frame if desired. Both rheostats are independently operated by concentric hand wheels on the front of the board. In the case of very large machines the face plate only is on the switchboard, the rheostat being placed in any convenient place and connected to the face plate by insulated wires.

Regulators for single-phase feeders may be mounted directly below the feeder panels. For a two-phase feeder panel the regulator is not mounted on the board, but it is a separate piece of apparatus placed directly in front of the feeder panel to which it belongs.

ELECTRIC RAILWAYS

The Decatur, Ill., Traction Company has recently let contracts for $51,000 worth of material to be used in betterment of the street railway system.

It is reported that during the coming Summer a line of electric railroad will be built along the east shore of Lake Winnebago, northward from Fon du Lac, Wis.

It is stated on reliable authority that the Citizens' Traction Company, of Oshkosh, Wis., has been purchased by the Emerson McMillan Company, of New York, the owner of several gas and electric plants in Wisconsin.

The Union Traction Company, of Philadelphia, has awarded contracts for 100 new open cars to be ready for the approaching Summer season. This order brings the number of new cars for that company either placed in service or in process of construction since the first of last year up to about 3,500.

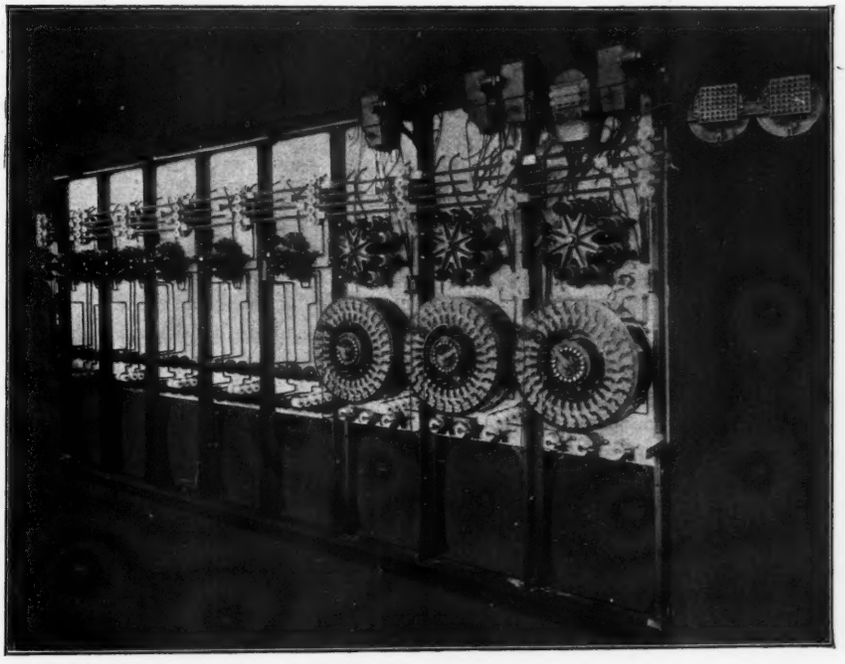


FIG. 2.—REAR OF EIGHT PANEL ALTERNATING CURRENT SWITCHBOARD.

The Albany & Hudson Railway and Power Company has been granted permission to operate that portion of its line outside of cities by third rail power and the remainder by the overhead trolley system. The company expects to run its cars over the United Traction Company's tracks from Rensselaer, across the lower bridge and into Albany as far as Broadway and State streets.

Application has been made to the Secretary of State, of Illinois, for the incorporation of the Geneva Lake, Sycamore & Morris Electric Railroad, with principal office at Sycamore. The line is to extend from Morris, Ill., to Geneva Lake, Wis., with branches to DeKalb and Belvidere. This is practically the old Geneva Lake, Sycamore, Southern Electric Road. The capital stock will be $150,000. It will be the longest electric line in the world. The work will be pushed. The survey has been made and right of way secured under the old company.

The Phœnixville & Bridgeport Electric Railway Company has secured the right of way from Phœnixville, Pa., to Valley Forge, and as soon as the right of way through Upper Merion Township is secure the company will begin the building of the road. The road will be built from Phœnixville to Bridgeport, a distance of 12 miles, by the way of Williams' Corner, Valley Forge, Port Kennedy and King of Prussia. It will traverse a region noted for the beauty of its scenery and its historic associations. The incorporators of the new company are Colonel H. H. Gilkyson, Phœnixville; Joseph McCarrell, Findley P. Bane, James W. Perry, Philadelphia; George F. P. Wanger, Pottstown. The company expects to have the road in operation by next July. This road, when completed, will make a complete trolley line from Philadelphia to Spring City, and with the building of three miles of road Pottstown would be connected with Philadelphia.

ELECTRIC LIGHTING

At a meeting of the trustees of the new municipal electric light plant of Lowellville, Ohio, the contract for the supply of machinery, etc., was awarded to B. P. Foster, of Cleveland. His bid was $7,500.

At the annual meeting of the Patchogue, L. I., Electric Company the following directors were elected: A. H. Carman, George D. Gerard, R. S. Pelletrau, John S. Havens, Edwin Bailey, James H. Mills, I. G. Willetts, Fremont Hammond, Henry Gillette, N. O. Swezey and Jesse C. Mills.

At a meeting of the stockholders of the Edison Electric Illuminating Company, of Brooklyn, the following directors were elected: Anthony N. Brady, William Berri, Charles Cooper, Horace Du Val, Walton Ferguson, Bernard Gallagher, Hugh J. Grant, Seth L. Keeney, Thomas E. Murray, R. C. Peabody, W. F. Sheehan, T. S. Williams and A. M. Young.

The immense water-power of the new ship and drainage canal, estimated to be worth millions of dollars, is to be utilized and controlled by the municipal government of Chicago, if plans laid by Mayor Harrison are carried to a conclusion. The Mayor says that the passage by the City Council of an ordinance authorizing the issuance of $2,500,000 bonds for the construction of a power plant at Lockport is but a step in the movement to secure the power for municipal purposes.

The following were elected directors of the Cincinnati Edison Electric Company at the annual meeting of the stockholders: George R. Sheldon, C. W. Wetmore, C. R. Spofford, A. Marcus and William N. Cromwell, all of New York; George Bullock, Maurice J. Freiberg, James J. Hooker, J. B. Foraker,and W. F. White, of Cincinnati. At the organization of the board Mr. Bullock was re-elected president, Mr. Wetmore, vice-president, and W. F. White, general manager. The contract for the storage battery, which is to be located in the cellar of the new Fifth street building, has been awarded to the Electric Storage Battery Company, of Philadelphia, at its bid of $10,000. Contracts for the generators, amounting to $78,000, were let to the General Electric Company, of Schenectady, N. Y., and for the engines, amounting to $10,000, to the E. P. Allis Company, of Milwaukee. Wires in the territory bounded by Third street, Broadway, the canal and Central avenue will be placed underground at a further cost of $10,000.

BRITISH NOTES.

(From our special Correspondent.)

I do not know that electrical science has materially advanced since I last wrote. One after another municipalities are falling into line—or perhaps I should rather say, trying to make up for past neglect—of the spirit of the times, with the result that what we over here call provisional orders for supplying of electricity, whether for lighting or traction, are being rapidly formulated and taken out. That does not mean, of course, that they have been procured, for they have still to pass the ordeal of Parliament, and any minute flaw in the observance of the red-tape regulations for that purpose will be sufficient to wreck them. But in these matters we always hope for the best, and seeing that the complexity of parliamentary procedure has, like the complexity of the law, created a special class of lawyers and engineers to study the subject and pilot plain folks through its intricacies, I suppose we can say "that it is an ill wind that blows nobody any good" and put a good face upon matters. Of course I believe this is a bad political economy; rather on a par with that of the inhabitants of a desert island, who are earning a precarious living by taking in each other's washing, but still it fits in with human nature, and after all that is the main factor in the situation. If half these provisional orders are granted, a very few years should see the whole face of the country changed, electric tramways radiating in all directions from our great cities, and electric light everywhere. But this is not yet, and perhaps it is not wise to "count one's chickens before they are hatched."

I have spoken to you at different times of the *bête noir* of every patriotic Englishman, the National Telephone Company, to which we owe it that the telephone industry is in such a stationary, or even decadent state in this country. The last move of this corporation is characteristic. Recent and heavy snow-falls have somewhat interfered with their ultra-villainous service, and the company has seized the opportunity to issue a circular to its supporters—or I should rather say, its subscribers, for very few people would support it if they could help it—to the effect that the dislocation in their service, though due primarily to the snow, is actually the result of the obstinacy of the London County Council, which refused to grant them way-leaves for underground conduits for their wires, although negotiations on the subject have been going on for some four years past. Now the London County Council is almost as unpopular as the National Telephone Company, and so folks were pleased and the rights of the case were a little ignored. For really in this particular instance the London County Council was not to blame. It had reached even the thick intellect of the London County Council that Londoners were paying twice as much for their telephone service as persons in the country, and that both residents in the country and residents in London were being fleeced to a tune far higher than that which obtains on the continent. So the London County Council had made it a condition of the way-leaves being granted that the rates should be reduced; the National Telephone Company had "told them in emphatic language what they would be before they had it" and the result was a deadlock. I wish I could say that some pressure had been brought on the National Telephone Company to behave themselves, but practically little or nothing has been done. It is a regrettable circumstance, to which I alluded before in one of my letters to you, that certain highly-placed persons in Parliament are interested in the fortunes of the company and that until their opposition can be got over public interests are not likely to be seriously considered. As regards London, the Post Office is coming to the rescue and is going to lay the underground service right over London. But this will take some time to carry out and for the present we must possess our souls in such patience as is possible.

Electrical break-downs are still disagreeably numerous, although perhaps not so numerous as they were a short time ago. Well, I do not think that some central station managers, at all events, are going about reforms in a right way. This week it is announced that a certain central station has decided to give its employees a bonus on a sliding scale, proportionate to the reduction in the price per unit to which electricity supply is turned out. Now, this, of course, makes for economy, but whether it makes for efficiency is quite another matter. It has been suggested that against the bonus should be set a scale of deductions in somewhat similar proportions for break-downs. This would lead in practice to a sort of payment by results which in the long run is one of the best methods of remunerating labor, though this, too, has its disadvantages. But to pay a man for economy without efficiency strikes me, and a good many other people, as a particularly risky thing to do. We shall hope to see the result later on.

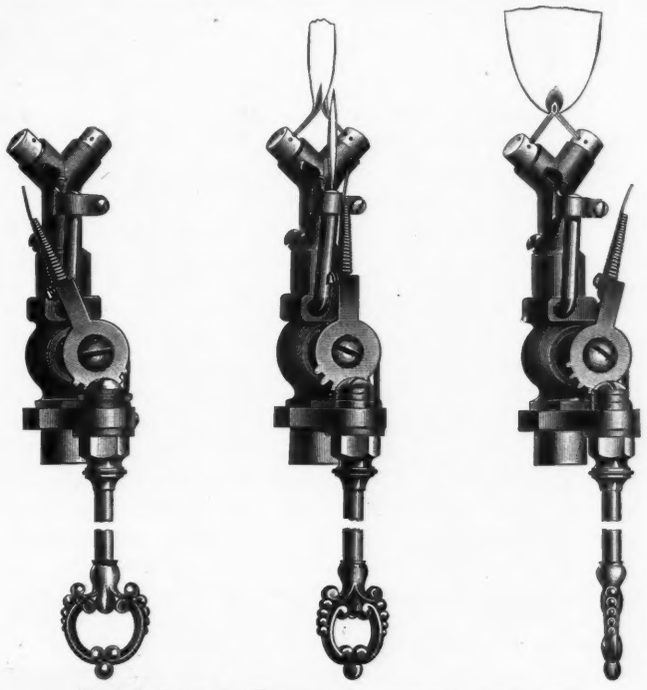
I told you some time ago of the difficulties which beset the Cardiff Town Council over their electric lighting installation. The Cardiff Town Council in fact wished—to use a colloquial phrase—"to have their cake and eat it too." They desired to have an expert to run the show for them but they desired also to have the promotions and the patronage in their own hands. The unfortunate expert, of course, had a bad time, and as the Council insisted on one promotion after another of inefficient subordinates, frequent break-downs followed and what was even worse, the discipline in the staff slackened from day to day as they saw the rulings and wishes of the resident engineer overruled by the authorities. Men were absent from duty, and neglected to carry out orders, and could not be found when they were wanted. Matters came to a head the other night, when a worthy town councellor was giving a ball to celebrate his silver wedding, for the lights went out and there was general confusion. This, of course, was quite intolerable and so the matter has been taken up and after any amount of wrangling the resident engineer has been given a free hand to promote, degrade and dismiss subordinates, and generally to overrule the whole working of the system; in fact, he has been placed in the position which he should have occupied from the first. Six months have been given him in which to remedy matters and I hope that he will succeed in that time, though of course it is impossible to estimate thoroughly the extent to which the mischief has spread. Still the object lesson to other municipalties is a useful one and I hope it will be duly taken to heart.

There was an important discussion at the Institution of Electrical Engineers this week upon the "Standardization of Electrical Engineering Plant." The lecturer's idea was to introduce a system of standards for various collections of plant such as I understand has been so brilliantly successful on your side of the water. Consulting engineers should not, according to him, specify all the details of the construction of the machinery, as they are given to doing, but they should specify the results to be attained and details and instructions should be left to practical men who are more familiar with them. Of course this led to an interesting discussion, but in the main the meeting was with the lecturer, and for myself I must hope that something of the kind will be done, for at present matters of this kind over here are in a state of chaos.

London, February 16.

Electric Gas Lighting Applied to Acetylene Burners.

For the successful burning of acetylene a special form of burner, different from the ordinary bat's-wing or fish-tail tip used with illuminating gas is requisite. The electrical ignition of acetylene issuing from such a burner presents considerable difficulties, which have been overcome very ingeniously in the contrivance herewith illustrated.



FIGS. 1, 2 AND 3.—ELECTRIC ACETYLENE GAS LIGHTERS.

A "pilot flame" is used, this consisting of a small, pointed flame issuing from a round orifice. When the key operating the burner is turned gas is admitted both to the pilot flame and the service burner. The electric spark formed at the electrodes ignites the pilot flame, which in turn lights the illuminating flame. When the key is fully turned so as to open the full flow to the illuminating flame, the pilot flame is extinguished. These actions are clearly shown in the accompanying illustrations. The apparatus, which is known as the Advance acetylene burner, is made by the Electric Gas Lighting Company, of Boston, Mass., who also manufacture many other forms of electrical gas lighting apparatus.

New Standard Types of Electrical Measuring Instruments.

The accompanying illustrations represent the types of direct-current instruments manufactured by the Jewell Electrical Instrument Company, of Chicago, Ill. This line of instruments comprises ammeters, milli-ammeters, voltmeters and milli-voltmeters made up in switchboard, portable and laboratory styles. The portable instruments are put up in a neat hard-wood carrying case in size 6¾ by 6¾ by 3¾ inches, and are so constructed as to withstand the rough usage to which portable instruments are frequently put; their bases are of hard rubber. The switchboard instruments have a similar movement to the portables, set up in a cast-iron case suitably finished in brass, nickel or japan, which acts as a magnetic shield. These instruments have rear connections and the voltmeters have an adjustable "normal index"; in size they are 10 inches in diameter. These are all of the D'Arsonval type, having a coil moving in the field of a permanent magnet. The permanent magnets are made from imported magnet steel, and are thoroughly aged before being placed in the instrument. The springs are made from a special low-resistance, phosphor-bronze alloy having a fine temper. The series coils in the voltmeters and the shunts in the ammeters are made from an alloy having a zero temperature co-efficient. The voltmeters have a resistance of about 120 ohms per volt of scale, *i. e.*, a 0—150 voltmeter has a resistance of 18,000 ohms.

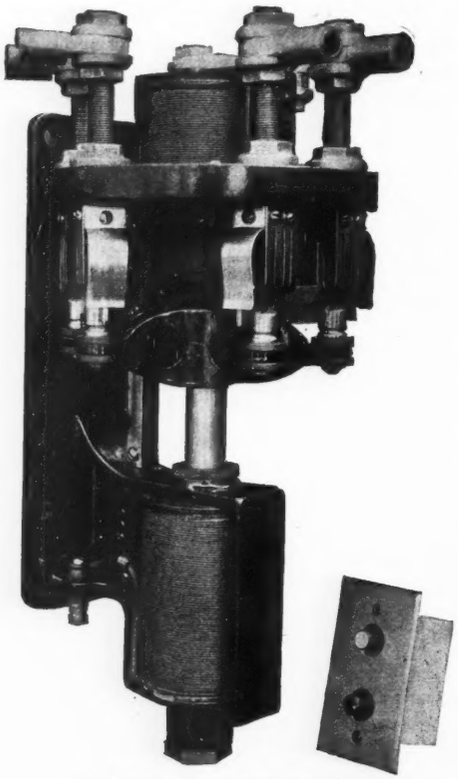
The special features of this instrument, as pointed out by the manufacturers, are rigidity of construction, dead-beat qualities, constant temperature co-efficient of the instrument, which is stated to be unaffected by changes in temperature, and hand-drawn scales from recognized standards, which insure correct readings. The scale divisions are uniformly spaced, and there can be no magnetic lag since there is no iron in the moving parts; the scale readings begin at 0. Only a small amount of energy is consumed by the meter, a 150-voltmeter, consuming but one and one-quarter watts on the full deflection. The makers claim fair accuracy for the instruments in all positions and absolute accuracy in the position in which they are calibrated, whether vertical or horizontal. A device for eliminating the effects due to static electricity is included. The scale is adjustably operated by a small, milled head, partially projecting through the case, which, on being turned by a rub of the finger, operates a micrometer screw which in turn shifts the entire scale, bringing its zero to the zero position of the needle should the latter become bent by any mishap.

FIGS. 1 AND 2.—NEW STANDARD TYPES OF ELECTRICAL MEASURING INSTRUMENTS.

A Long-Range Automatic Switch.

This switch is designed to control any number of electric lights or motors, etc., from one or a number of distant points, without running the heavy mains to the point of operation.

Essentially the switch consists of a pair of solenoids held firmly in an iron frame,



A Long-Range Automatic Switch.

which acts as a return path for the magnetic lines of force and thereby tremendously increases the "pull" during the time of opening or closing of the switch. As the switch begins to move the "pull" continually increases in strength until it reaches its maximum at the end of the stroke. This feature is very essential in closing the switch, as the magnetism has to overcome the friction of the contacts and any hesitancy on the part of the switch to continue its motion at this moment would produce excessive arcing and pitting, thereby further preventing the switch-blades from entering the clips.

The lower core has a lost motion which is first taken up by the solenoid, producing a sudden and severe hammer blow which opens the contacts and is followed by the strong accelerating pull of the magnet until the final position is reached. There is no danger, therefore, of the switch stopping or even hesitating after it has once started to close or open.

The contacts are made very flexible so that there is no possibility of their sticking; they are also self-adjusting and make a flat rubbing surface. It will be seen from the illustration that the current is broken in two places on each pole, making six breaks in a three-pole switch. The illustration shows a 100-ampere three-wire switch such as is used on the Edison three-wire system, but the makers also manufacture single, double and triple-pole switches for any capacity, voltage or system. "Arc catchers" are provided on each one of the contacts, so that whatever arcing occurs in operation will be taken up by them, and the contacts will not be burned or their temper reduced.

As the solenoids can be wound for any voltage, batteries may be used to operate the switch if it is not desirable to use the lighting circuit for that purpose. The method is often employed when it is desired to cut the lighting or power service entirely out of the building at night. The push-button switch is made in a very substantial manner and will fit into any flush receptacle. The buttons, one black and one white, enable the operator to tell at a glance which to press in order to open or close the switch.

The switches are made for any ampere capacity from 15 to 200, single, double and triple-pole. They are described and illustrated by their manufacturers in Bulletin No. 53, of the General Incandescent Arc Light Company, 572 First avenue, New York.

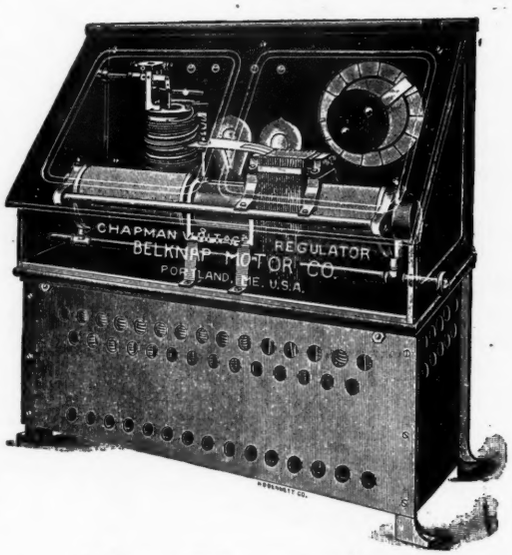
The recent sale of the Bonner horses calls out the story of the longest-spoken good-night on record, says the New York *Mail and Express*. It is passed between this city and Cincinnati daily. At this end of the wire, according to the statement of a telephone employee, is a young matron for whom, in her childhood, Maud S., now of the Bonner stable, was named. At the other end of the wire is Captain Stone, her father. At sharp 10 o'clock, so the story goes, the long-distance wires are connected between the two homes and the greetings are passed. This has been practiced regularly for several years—ever since the young woman became a wife. This is probably the only good-night of its kind spoken on earth. Captain Stone is general manager of the telephone company in Cincinnati. This illustrates the great possibilities of the telephone, as persons with enough money need never be out of the sound of voices they love to hear.

A Regulator of Voltage.

Perhaps the qualities which most distinguish American electric station auxiliaries are their ingenious adaptation to the saving of labor and attention, and their automatic character. One that has been much appreciated abroad is the ingenious regulator or governor of voltage herewith illustrated. This machine is automatic in action, very quick in response, and is adapted for either direct or alternating-current circuits of the constant potential variety.

The regulator works by the adjustment of resistance in the field circuit of the dynamo with which it is connected; it takes the place of a man with his eye on the voltmeter and his hand on the rheostat wheel, but it is quicker, and its attention can not be diverted.

A relay with a high-resistance coil is arranged to move a light lever as the voltage rises or falls within narrow limits. This lever closes or opens a circuit through a solenoid which operates the moving contact of the rheostat. The relay may, of course, be made as sensitive as is desired, while the rheostat, it is claimed, can be



A Voltage Regulator for Dynamos.

built to take care of speed variations as high as from 25 to 30 per cent.

The instrument, which has long been known as the Chapman voltage regulator, is built by the Belknap Motor Company, of Portland, Maine. It will be used in connection with the United States government exhibit at Paris, this Summer, and is in extended use abroad as well as in this country.

Capital Increased.

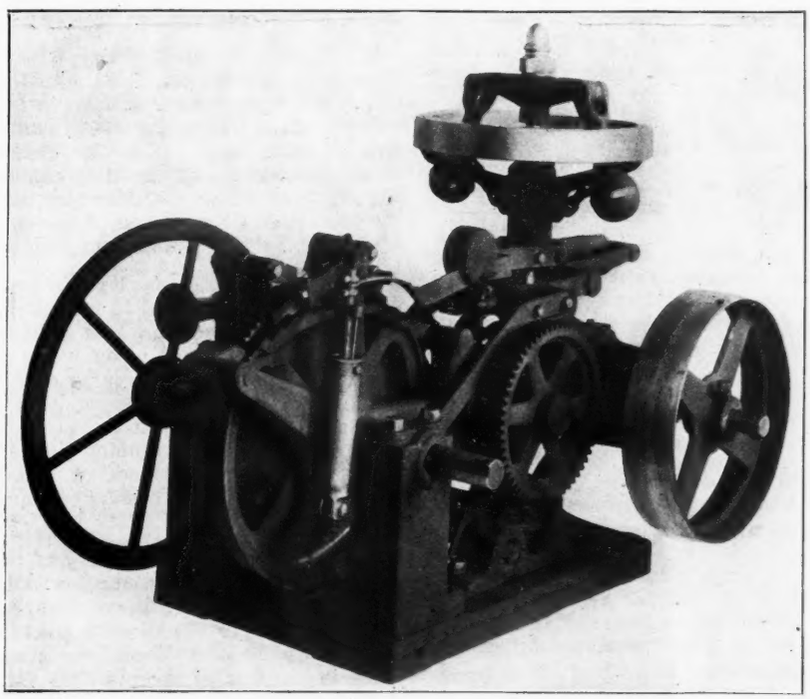
The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., manufacturers of high-class rheostats, has increased its capital stock to $150,000.

The Duplex Water-Wheel Governor.

The question of governing water-wheels is one upon which a great deal of ingenuity has been expended. The type of governor illustrated herewith is one in which a differential relay is used, the action being mechanical throughout; it is intended more for the small water-power plants where close regulation is desired than for the larger installations in which different conditions may require different types of governing mechanisms.

When changes are made in the load upon the wheel the gate movement initiated by the governor automatically cuts the governor out of action in order to prevent racing. To put it in another way, there is a quick movement of wheel gates to correspond with the change in the load at the time of change, but this movement is stopped in time to allow the gravity effects to correct the effects of inertia and momentum. The governors are geared to move the gates through their full range in from 15 to 25 seconds. This quick movement without racing is a vast improvement over the old style of mechanical governor in which anywhere from one to five minutes were required to operate the gates and where, for many minutes after the change in load, the speed would "hunt" for its proper rate.

These machines are built by the Replogle Governor Works, Akron, Ohio, which has already installed many of them in the United States and foreign countries.



A Duplex Differential Relay Water-Wheel Governor.

An American Electric Railway Installation on the Isle of Man.

The Isle of Man lies in the Irish Sea off the Solway Firth, and about equally distant from the mainlands of England, Scotland and Ireland. It is only recently that it has been invaded by an electric tramway, extending along the eastern side of the Island from Douglas, the principal town, through the port of Laxey, to Ramsey. The entire line is 18 miles long and is operated part of the year solely by water-power. Its principal income is derived from tourist traffic in the Summer months when the load of the several power stations rises as high as 2,200 horse-power. During the other half of the year the local passenger and freight traffic is comparatively light. The water-power station was designed by Mr. J. Shaw in order to operate the line during the slack months when it is necessary to keep down the expenditures. As it is necessary to import from Wales all the coal used, the financial saving thus effected is considerable.

Crossing the line at a point 11 miles from Ramsey and seven miles from Douglas is the Laxey River, a rapid stream descending from Snaefell Mountain to the east. The water, after passing through the "wash-floors" of the lead mines at Laxey, is taken by the water-wheels and then discharged directly into the sea. The total fall available is 38 feet.

As the water is used for ore washings before it reaches the wheels it contains a great quantity of sand and dirt, and special precautions are necessary to keep this out of the wheels. An elaborate concrete weir, 40 feet long, was built across the river with masonry archways at one end fitted with gates. A grating 55 feet long separates these gates from the river. During floods a large amount of debris is washed down and the grating is found very useful in protecting the gates from being blocked. Inside the grating is a large settling tank in which the sand brought down by the water gathers. The head race is 1,300 feet long, of which the first two-thirds is made so wide that the water travels through it very slowly. This permits the final settlement of any sand that escapes the catch-basin described above.

The tail-race ends in a masonry head-box, from which the water flows 820 feet to the turbines through steel pipes three feet in diameter. The pipe line is above ground and is supported on masonry piers.

The water-wheels are of the "Victor" horizontal type, consisting of two 12-inch independent turbines in one case, with their shafts coupled together so that when only a small amount of water is supplied one wheel may be used alone, thus enabling the plant to work at high efficiency. The wheels develop 140 horse-power at 720 revolutions per minute. The wheels were built by the Stillwell-Bierce and Smith-Vaile Company, of Dayton, Ohio.

The electric plant consists of a combined two-pole dynamo and booster, the generator giving 180 amperes at 520 volts and the booster operating in the same current at from 100 to 200 volts. The generator and booster are coupled to the wheel by friction clutches so that in the Summer time, when the river is very low, the plant may be used as an ordinary motor-driven booster. The mains belonging to this plant are carried 1,000 feet overhead to the company's steam plant, from which the turbine station is controlled. Two Lundell one-quarter-horse-power motors driven from a little storage battery are used to manipulate the turbine regulators. The switchboard for the whole outfit is in the steam station. Among other devices contained by this board is a gauge glass connected by a small pipe to the head-race so that the attendant can see at a glance the height of the feeding water.

Three storage battery sub-stations are used in connection with the railways, all three of them being worked in parallel. The Isle of Man Tramways and Electric Power Company was the first in the United Kingdom to use storage battery sub-stations for traction purposes.

The turbine plant described above has recently completed a 240 hours' continuous test, during which it maintained a steady load varying from three-quarters to full-load; and although the turbines are not provided with any governor, it was not once necessary to alter the regulation.

INDUSTRIAL NOTES

The Electric Appliance Company, Chicago, has arranged to handle the well-known line of Dayton fans for the season of 1900.

The Elwell-Parker Electric Company, Cleveland, Ohio, manufacturers of dynamos and motors, are preparing to erect an addition to the present plant.

The Columbia Incandescent Lamp Company, of St. Louis, is at present paying particular attention to export orders and is sending out of the country many of its well-known incandescent lamps.

The Williams Electric Company, Cleveland, Ohio, states that all of its departments are in vigorous operation, with orders for telephone apparatus now in hand sufficient to keep it active for 30 days.

The Erie Telephone System made a net gain of 3,094 subscribers in February. The total number connected on February 28, was 113,327. The number of subscribers waiting connection, is now 5,580.

I. P. Frink, New York, the well-known manufacturer of shades for electric, gas and other lights, for all purposes, has recently issued a little pamphlet called "A Book of Light," which is sent promptly to those who apply for it.

The Shelby Electric Company, of Shelby, Ohio, is meeting with great success in the manufacture of incandescent lamps. It has a staff of able electricians and chemists and as a natural result turns out lamps of the finest quality.

The Helios-Upton Company, Chicago and Philadelphia, has entered the storage battery field, and is now producing the Morrison cell, which is adapted for all purposes for which storage batteries are used, including automobiles.

Schiff, Jordan & Company, of New York, state that the hard Nuernberg carbons which they import are coming more and more largely into use for enclosed arc lamps, and are found particularly effective with the alternating-current series arc lamp.

The Manhattan General Construction Company, Newark, N. J., is meeting with much success in the placing of its system of enclosed alternating-current series arc lamps. These lamps are stated to possess a power factor of .91 and an efficiency as high as 99 per cent.

The Warren Electric Manufacturing Company, of Sandusky, Ohio, is enjoying a large sale of its inductor type alternator. This machine, which has no moving wire, has recently been described as being "as simple as a grindstone and as sparkless as a water-wheel."

The Green Fuel Economizer Company, of Matteawan, N. Y., has now applied its system of fuel economizers to the astounding total of 30,000,000 horse-power in boilers. The company publishes a descriptive book showing the advantages of economizers, which may be had upon application.

The Crown Woven Wire Brush Company, of Salem, Mass., announces a larger sale of its "Crown" and "Crown K" dynamo brushes than has been experienced for several years, and the factory is taxed to its utmost to fill the incoming orders. It also reports much new business from foreign countries.

The Kerite insulated wires and cables are not only widely known in this country but abroad, in the continent of Europe and in the South American countries. Mr. W. R. Brixey, the sole owner and manufacturer, has recently made several very handsome sample boards, one of which has been shipped to Japan.

The American Engine Company, Bound Brook, N. J., which builds the American-Ball compound and simple engines, is doing a large business in engines adapted for direct-coupling to dynamos, especially for isolated plant work. Its compound engine has proved particularly successful and economical in this class of work.

The Burnley Battery and Manufacturing Company, Painesville, Ohio, manufacturers of the Burnley dry battery, are also makers of the Burnley soldering paste, which is conveniently marketed in ¼, ½, 1, 5 and 10-pound packages. It is claimed that over 200,000 quarter-pound boxes of this soldering paste were sold during one year.

Edwards & Company, of New York, manufacturing electricians, are making a feature of the Lungen buzzer, which is manufactured in a number of sizes. The case is entirely dust-proof and the contacts in the machine are platinized. A regulator of the tension adapts the buzzer for use on different battery circuits and in different situations.

Partrick, Carter & Wilkins, Philadelphia, the well-known manufacturers of electrical house goods, publish a catalogue showing a great number of varieties of annunciators, bells, batteries, push-buttons, etc. This house was established 33 years ago and is probably the oldest concern manufacturing similar goods in the country.

The American Steel and Wire Company, of Chicago, New York and San Francisco, is at present exporting much insulated wire of various kinds, especially the "Crown" and "Globe" brands of rubber wire for high and low voltages respectively. This company is now manufacturing feeder cables in capacities up to 2,500,000 circular mils.

The Belden-Larwill Electric and Manufacturing Company, Fort Wayne, Ind., which makes the well-known Belden arc lamp, has published one of the most interesting and artistic descriptive pamphlets concerning its lamps that has appeared. These lamps, which are of the enclosed pattern, and are "built like a bicycle," have ball bearings and steel tubular framing.

The Keystone Electrical Instrument Company, Philadelphia, of which Mr. J. Franklin Stevens is the president, has printed a catalogue showing the complete line of standard measuring instruments manufactured in its shops. The line of instruments now includes practically every variety of electrical instruments of precision.

The Okonite Company, Limited, New York, is largely engaged at present in the manufacture of telephone, telegraph and power cables for deep-sea work. A cable was recently laid by this company in an exceedingly difficult and exposed position on the Massachusetts coast, with great success. The factory at Passaic, N. J., is filled with orders.

The Garton-Daniels Company, Keokuk, Iowa, manufactures the well-known Garton lightning arrester, which has the peculiar merit of opening the circuit in two places at once. It is also claimed that this instrument has the smallest air-gap used in any similar protective device. With the approach of Spring a great number of orders are being booked.

The George C. Towle Manufacturing Company, of Lancaster, Pa., reports that the month of February has been an exceptionally busy one in its power motor department. It is having a large demand for its neat, new illustrated catalogue of fans and motors, which can be had for the asking. The factory is running night and day hurrying a large stock of fans to completion for the coming Summer season.

The Crocker-Wheeler Company, of New York, has just closed a contract with the Anglo-American Provision Company, of Chicago, for a 350-kilowatt generator for the Union Stock Yards, in Chicago. This is the first of the machines for a large equipment. In the ELECTRICAL REVIEW for February 21, in a note concerning the establishment of a southern office by this company at Atlanta, Ga., the name of its representative, Mr. Louis P. Hall, was erroneously given as Hale.

The Michigan Electric Company, of Detroit, carrying the title of "the largest supply house in Michigan," has become, under the able management of President Joseph E. Lockwood, an important and progressive factor in the electrical business of the middle northwest. This company handles the product of the leading manufacturers in switches, lamps, fan motors and power motors generally. It makes a specialty of electric sign designs and has an enviable reputation in this particular field.

The Federal Battery Company, No. 11 Pine street, New York, manufactures "Federal Salt," adapted to all open-circuit batteries. A graphic presentation of the excellent qualities of this sale is shown in the illustrations in the ad-

vertisement of the company in this issue. No crystals are to be seen on the Federal salt battery. The company also manufactures "Federalite," the claims for which are that it gives higher voltage, longer life, more constant current, no crystals. It is especially recommended for carbon cylinder batteries.

The Wagner Electric Manufacturing Company, St. Louis, is meeting with extraordinary success in the introduction of its single-phase dynamo motors. These machines are of a compound series motor and induction motor type, the armature being run up to speed with the machine working as a series motor and when in synchronism the armature is short circuited and the machine runs on as an induction motor. The use of these machines is extending widely and in the city of St. Louis alone the total power developed by them amounts up to extraordinarily large figures.

Messrs. H. B. Russell & Company, of Washington, D. C., are publishing weekly lists of patents granted by the United States patent office, which consist of copies of the drawings, specifications and claims, with lists of references cited, etc. These are published in magazine form and are most convenient for the engineer, designer, or inventor. The drawings are given in full, and the specification is also full, which makes the work very different from the *Patent Office Gazette,* published by the government, which gives only the plans and one of the drawings, in case there are more than one in the patent.

The Emerson Electric Manufacturing Company, St. Louis, Mo., has sent out this announcement: In order to serve our eastern customers more promptly and satisfactorily, we have opened a branch office in New York city, at 136 Liberty street, and shall carry a large stock of all regular motors for prompt shipment from that city. This office will be in no sense a mere sales agency, but will be a branch office of the company, in charge of one of our officers. We shall notify the trade promptly when motors are ready for shipment from New York. Any inquiries addressed to our New York office will receive prompt attention."

"A Dollar Saved is Two Dollars Earned" is the homely aphorism which the American District Steam Company, of Lockport, N. Y., uses to illustrate its method of increasing electric central station revenues by disposing of exhaust steam at profit. This exhaust steam, which is the only by-product of such a station, is far too generally thrown away. The American District Steam Company, however, is installing now in many places its system which has worked so advantageously in the numerous towns and cities where it is used, to the great saving of money for the electric companies. The exhaust steam is distributed for heating and a source of waste thus turned into a source of revenue.

The Bunnell Telegraphic and Electrical Company was recently organized by DeWitt C. Bunnell, Mrs. Jesse H. Bunnell (son and widow of the late Jesse H. Bunnell), and others, to manufacture telegraphic, electrical and railway supplies. The company announces that it is the owner of all patents of the late Jesse H. Bunnell, and is the sole manufacturer and seller under such patents, and will manufacture the apparatus covered by these patents, particularly those covering telegraphic devices. The company has employed a number of skillful workmen, familiar with the late Mr. Bunnell's work, and has the entire building, 110-116 Beekman street, New York, for a salesroom and factory. The building is to be fully equipped with modern machinery.

The United States Carbon Company, of Cleveland, Ohio, report that they have fully recovered and rebuilt since their fire of last November, and are now in full operation. Their open arc-light carbons have met with great success on the market, and they have recently erected two large brick factory buildings, thereby greatly increasing their capacity. They announce that they are the only carbon company in the United States not in the so-called carbon "trust." Their plating department, which was completely destroyed by the fire, has been replaced by a temporary one, and is now in full operation, and they report that they will have installed before May 1, a new plating plant of the latest and most efficient type, whose output will greatly excel that of any machine now in use, and they therefore will be able to fill all demands during the coming year for copper-coated open-arc carbons.

Receiver for Third Avenue Railroad Company.

Mr. Hugh J. Grant, ex-Mayor of New York city, has been appointed by the court temporary receiver for the Third Avenue Railroad Company, with the probability that he will be made permanent receiver of the property. Mechanics' liens aggregating nearly $3,000,000 have been filed against the company and its subcompanies, and its financial affairs are so complicated that no exact knowledge of its assets and liabilities is obtainable. It is understood that the company's records are in a chaotic state and that it will take experts some time to find out its exact status. Mechanics' liens were filed by the National Conduit and Cable Company, John A. Roebling's Sons Company, the Safety Insulated Wire and Cable Company and several other concerns, for material and labor supplied. Receiver Grant has deposed nearly all the old officers of the company and has filled their places with people of his own choosing.

The New England Telephone Company has sold about $400,000 30-year four per cent debenture bonds. The price is not given out, but is thought to be about par. Bids were privately solicited for $1,000,000 bonds, but only the above bid was accepted.

The Victoria Nyanza Telegraph Line.

The completion of the telegraph from the Indian Ocean to Victoria Nyanza puts the world in communication with the sources of the Nile. The telegraph has been completed to Ripon Falls, which is the exact point where the White Nile leaves the lake, says the New York *Sun.* One of the most useful results of this enterprise will be that the people of lower Egypt will be able to tell what the water conditions of the lower Nile will be for months in advance. This information will give most desirable guidance in regulating the quantity of water to be taken from the Nile for irrigation purposes. Many occasions have arisen when information as to the stage of the water in the upper Nile would have been worth millions of dollars to lower Egypt.

The cable does not yet touch at Mombasa, which is the sea end of this land line. Despatches from Victoria Nyanza must therefore be sent by steamer to be put on the cable at Zanzibar, which will delay forwarding messages for several days. Thus it happens that the news of the completion of the line to the lake was not received in this city for a week after it occurred. Five years ago, when the building of this line and the railroad alongside of it was begun, the shortest time in which news from the lake could reach Europe was about four months.

The report of Sir Guilford Molesworth, the consulting engineer, published in July, last, showed that the survey of the route finally adopted for the railroad had been completed clear to the lake. The railroad was built and in operation from the sea to Kiu, a distance of 270 miles inland, and between that point and Angata-el-geik, 399 miles in the interior, the road was in course of construction. The railroad is to terminate at Port Florence, at the extreme northeast corner of Victoria Nyanza instead of being extended about 60 miles further west to Port Victoria, as was at first contemplated. Probably three years will yet elapse before the completion of the railroad.

The first telegraph completed to the Central African lakes was that to Blantyre, in the Nyassa highlands, and as it is connected with the cable on the Portuguese coast communications between Lake Nyassa and Europe are promptly delivered except when the land line is out of order as occasionally happens.

Electric Light Apparatus Wanted.

Mr. J. P. Hornaday, attorney-at-law, Masonic Building, Somerset, Ky., informs the ELECTRICAL REVIEW that he and several associates contemplate installing an electric light and power plant at Somerset. Mr. Hornaday wants only the most modern equipment and states that he would like to have estimates from manufacturers and construction companies.

ADVANCE INFORMATION

Electric Light and Power.

SYRACUSE, N. Y.—The United Gas and Electric Company, of Syracuse, has been incorporated with a capital of $4,000,000, to manufacture gas and electricity. The capital stock is divided into $1,000,000, preferred, and $3,000,000, common stock. The directors are L. Bedell Grant and John T. Kirk, of Brooklyn, and Ashley T. Cole, of New York city. The company takes over the business of the present Syracuse Electric Light and Syracuse Gas companies, and its operations will extend throughout Onondaga County.

CHERAWA, S. C.—The Ashworth Electrical Company, of Cherawa, capital, $100,000, has been chartered. Rhode Island capitalists are back of it.

MONTICELLO, N. Y.—The Murray Electric Light and Power Company, of Monticello, has been chartered with a capital of $20,000; directors: Peter C. Murray, Delia Murray and Elmer S. Rockafeller, Monticello.

Telephone Companies.

WILMINGTON, DEL.—Gould Telephone Company, of Philadelphia, to manufacture and use telegraph, telephone and electric light products.

Miscellaneous.

NEW YORK CITY—The Magnet Wire Company, of New York city, has been incorporated. Capital, $25,000; directors: R. F. Manning and J. De S. McGuire, New York city; Richard Varley, Jr., Jersey City.

NEW YORK—Newton Electric Company, of New York city, capital, $1,000; directors: Dudley C. Newton, William J. Newton and Bernard J. Isicke, New York city.

CAMDEN, N. J.—Articles of incorporation were filed in the County Clerk's office recently by the Federal Oil Company, with a capital stock of $2,000,000 and $150,000 paid in. The incorporators are W. H. Zahnizer, E. R. Steyner, O. P. Boggs and H. R. Martin. The new corporation will deal in all kinds of oils.

ALBANY, N. Y.—American Pneumatic Valve Company, of Buffalo, capital, $10,000; directors: Henry J. Pierce, Pendennis White, William H. Gratwick and E. F. Pickett, Buffalo.

Electric Railways.

COLUMBUS, OHIO—The Columbus Freight and Traction Company has been incorporated by W. D. Brickell, William D. Park, William D. Hamilton, Charles E. Morris and John W. Mooney. The capital stock is fixed at $25,000. The articles state that the purpose is to construct railway track in the city of Columbus to be operated by electricity or other power, to own real estate and erect buildings, to develop electricity for their own use and to sell to others.

HUNTINGTON, IND.—Promoters and capitalists interested in a new electric railway to be built between this city and Portland, Ind., have held a meeting and organized the Oil Belt Traction Company of Indiana. It will be incorporated with a capital of $10,000. The president is Z. T. Dungan.

MENTOR, OHIO—The Cowle Transit Company, of Mentor, has been incorporated with a capital stock of $85,000. The incorporators are W. S. Manuel, N. B. Snavely, S. H. Holding, Frank S. Masten and B. Arp.

DOVER, DEL.—The Ohio River Electric Railway and Power Company, whose capital stock is estimated at $300,000, has filed articles of incorporation.

Telegrams and Mothers-in-Law and Fathers-in-Law and Mental Anguish.

In the case of Davidson *et al. vs.* Western Union Telegraph Company, the Kentucky Court of Appeals held that the law does not presume from the relationship of son-in-law and mother-in-law such affection as will authorize the son-in-law to recover for mental anguish caused by the failure to deliver a telegram announcing the mother-in-law's illness whereby he is prevented from being present at her death.

In the case of the Western Union Telegraph Company *vs.* Steinberger, the same court held that a father-in-law can not recover for mental anguish on account of the absence of the son-in-law at the death of his mother-in-law resulting from the telegraph company's failure to deliver promptly a telegram announcing the mother-in-law's illness, there being no blood relationship, and therefore no legal presumption of such affection as would authorize such a recovery.

In the latter case the court held that where the office hours of the company at the place where the message was to be delivered were from seven o'clock in the morning to seven o'clock in the evening the company was under no obligation to deliver a message received during the night until within a reasonable time after seven o'clock next morning.

Keep Off the Tracks.

The Supreme Court of Louisiana held, in the recent case of Knoker *vs.* Canal & Claiborne Street Railway Company, that where a pedestrian was standing near a car track at night upon a frequented thoroughfare, giving no indication of an attempt to cross, and attempted to cross only when a rapidly moving car was so near him as to render it practically impossible for the motorman to prevent it striking him, there could be no recovery of damages for the injuries sustained.—*Bradstreet's.*

TELEPHONE AND TELEGRAPH

Fire broke out among some coils of wire in the Construction Department's storeroom, on the lower floor of the Harlem Exchange Building of the New York Telephone Company, on the morning of February 24, and was extinguished with small damage. The report that it was due to electric causes is untrue, as the coils of wire were simply stored in this room and not connected with any source of currents. The fire-drill among the employees was at once initiated, and in 10 seconds the switchboard was covered with a tarpaulin and the operators were in the street within two minutes. The time taken by the operators to uncover the switchboard and resume their operations at the switchboard was thirty seconds, and the total time from the first signal until the operators resumed their duties, they having been down on the street in the meantime and seen that the fire was trifling, was seven minutes. The number of subscribers who complained of interruption was three. The fire itself was put out by the employees and was well under control before the fire department arrived. This statement of the facts from the official reports show that the ridiculous newspaper stories concerning a panic at the exchange were untrue.

The Eastern Shore Telephone Company, controlled by the Diamond State Telephone Company, has acquired control of the Union Telephone Company, of Talbot County, Md., and also the lines in Cecil County. This places the service in 12 counties on the peninsula.

All the city and county departments in the city of Cincinnati, Hamilton County, Ohio, have executed five-year contracts with the City and Suburban Telegraph Association (Bell Telephone Company) for telephone service.

Typographical Exposition in New York City.

An exposition of printing and typographical methods and machinery will be held at the Grand Central Palace, in New York city, beginning May 2, 1900, under the auspices of Typographical Union No. 6. Mr. Marcus Nathan, the general manager of the enterprise, states that "In seven of the contracts already closed with prominent manufacturers of printing machinery, there, will be, according to the plans submitted by these concerns, 21 electric motors in operation." Mr. Nathan feels confident that there will be as many more shown in exhibits which he expects to close within a few days.

ELECTRICAL PATENTS

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED FEBRUARY 27, 1900.

644,050 Manufacture of lead peroxid and its application to electrical storage batteries; H. Beckmann, Witten, Germany—A process of producing lead peroxid particularly as a coating for the electrodes of storage batteries which consists in introducing metallic lead into a solution of free sulfurous acid as a positive electrode and subjecting it to the action of an electric current.

644,051 Controller for alternating-current circuits; E. J. Berg, Schenectady, N. Y.—An induction motor, a resistance in the secondary of the motor, an inductance device in the primary leads of the motor, and a controller for varying the amount of said resistance and for varying the self-induction of said device.

644,072 Automatic gravity cutout for electrical circuits; W. Hanlon, Poughkeepsie, N. Y.

644,094 Electrical bond for railroad rails; J. M. Price, Philadelphia, Pa.

644,103 Contact device for conduit electric railways; C. F. P. Stendebach, Leipsic, Germany.

644,128 Automatic controller for electric compressors; N. A. Christensen, Milwaukee, Wis.

644,143 Electric gas-lighting candle-burner; R. N. Noyes, Haverhill, Mass.

644,144 Connecting plate for storage batteries; H. G. Osburn, Chicago.

644,160 Electric glow lamp; W. Boehm, Berlin, Germany—A glower which is a non-conductor at ordinary temperatures and become a conductor at higher temperatures, of a catalytically-acting body in proximity to said glower and arranged to heat said glower, means for supplying a gas to the catalytically-acting body whereby the latter is caused to heat the glower, and means for supplying current to the glower.

644,204 Switch-box for intercommunicating telephone systems; A. K. Keller, Philadelphia, Pa.

644,205 Telephone transmitter; A. K. Keller, Philadelphia, Pa.

644,206 Telephone receiver; A. K. Keller, Philadelphia, Pa.

644,251 Electric-contact apparatus; C. G. O. H. von Kohler, Stockholm, Sweden.

644,278 Means for regulating electric machines; W. H. Cooley, Brockport, N. Y.—A supply circuit, an electromotive force generator connected across the terminals thereof, a translating device and means whereby such translating device may be variously connected across the terminals of such supply circuit in series with any desired portion of such generator and in parallel with the remaining portion thereof.

644,311 Method of winding helices for electrical purposes; J. C. Anderson, Jersey City, N. J.—Consists in simultaneously winding a plurality of helices upon separated zones of a single core, and inserting sheets of insulating material between the superposed layers of the helices, each sheet being common to all the helices.

644,312 Electrical helix; J. C. Anderson, Jersey City, N. J.—Consists of a plurality of helices for electrical purposes, wound in layers on a single core, in combination with individual sheets of insulating material inserted between the layers and extending throughout all the helices.

644,315 Telephonic relay; F. H. Brown, Oak Park, Ill.

644,330 Electrical-measuring instrument; J. W. Packard, Warren, Ohio.

644,357 Multiple-fuse cutout; J. B. Hubbard, Baltimore, Md.

644,370 Apparatus for adjusting elevation of guns; G. A. Schoeller, Mulheim-on-the-Ruhr, Germany.

644,407 Automatic regulation of systems of electrical distribution; J. L. Creveling, New York, N. Y.

644,408 Car-lighting system; J. L. Creveling, New York, N. Y.—A dynamo and storage battery, the dynamo being liable to have its direction of rotation reversed, a pole-changing device adapted to control the circuit, positive-transmission means intervening between the rotating armature and the pole-changing device and electro-magnetic means in circuit with the dynamo for breaking the mechanical transmission.

644,409 Electrical distribution; J. L. Creveling, New York, N. Y.

644,433 Signal apparatus for boilers; W. B. Lowe, Jr., Atlanta, Ga.

644,448 Circuit closer for telegraph keys; E. E. Nye, Los Angeles, Cal.

644,497 Wireless telegraphy; A. F. Collins, Saratoga Springs, N. Y.—A receiving apparatus for wireless telegraphy, comprising a non-conductor tube, oppositely-disposed conductor plugs arranged within the tube, and having their inner ends beveled to form a tapering pocket adapted to receive loose magnetic particles, a local circuit embracing said plugs, and filings, and a magnet in said circuit arranged to act on said particles.

644,517 Resistance switch for electric circuits; J. H. Holmes, Newcastle-on-Tyne, England.

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